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Annual Report

To the Congress

Fiscal Year 1986

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, DC 20510-8025

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Section I.—Statements by the Chairman and Vice Chairman of the Board, TAAC Chairman, and the Director of OTA

CHAIRMAN'S STATEMENT—SENATOR TED STEVENS

The close of fiscal year 1986 marks the end of the 99th Congress and my second 2-year term as Chairman of the Technology Assessment Board. The 99th was a productive Congress, tackling many issues critical to the Nation's future, and OTA was constantly on the frontlines, providing timely information to assist every stage of the Congressional process.

Just prior to the convening of this Congress, OTA issued a report, *Protecting the Nation's Groundwater From Contamination*, that stated, among other things, that groundwater contamination has occurred in every State and is being detected with increasing frequency. This study provided support for the 99th Congress to expand legislative authority to curb growing groundwater pollution problems. OTA has also, during the past several years, published several reports that were very useful during reauthorization of Superfund, which occurred in the final days of the second session: *Technologies and Management Strategies for Hazardous Waste Control* (fiscal year 1983); *Superfund Strategy* (fiscal year 1985); and *Serious Reduction of Hazardous Waste* (fiscal year 1986). The availability of these detailed analyses before and during the debate preceding congressional action is evidence of OTA's increasing ability to anticipate issues of substantial concern to Congress.

OTA also demonstrated, in the past year, continued improvement in its ability to respond quickly to congressional needs for information—drawing from both completed and ongoing work. A staff paper, *Passive Smoking in the Workplace: Selected Issues*, was produced by OTA's health experts on very short notice as the Congress turned its attentions to the subject of workplace health. *A Special Report for the 1985 Farm Bill* contributed to that major piece of legislation from the 99th Congress, and OTA, during the rest of the session, provided testimony and briefings to the Members and staff who continued to work on improving basic farm legislation.

As Congress seeks to balance the need for government services with the need to control government spending, OTA plays an ever more important role. Technology is an increasingly pervasive element in most legislation considered today—whether it concerns genetic engineering, expansion of Medicare benefits, or intellectual property protections—and Congress requires expert information on these issues from a source within the legislative branch of government. OTA provides this service at minimal cost by serving as a shared analytical resource for the Committees. As the Office's skills continue to develop, it is money increasingly well-spent.

VICE CHAIRMAN'S STATEMENT—CONGRESSMAN MORRIS K. UDALL

Throughout fiscal year 1986, the Office of Technology Assessment continued to fill a dual role for Congress—providing assistance with current, urgent concerns, and providing foresight on emerging issues. Many of the documents produced by OTA during the past year were designed to help Congress address issues that are both long term in character and of immediate national concern. For instance, the following studies were completed in fiscal year 1986.

- *Technologies for Historic and Prehistoric Preservation*: Archaeological remains, historic structures, and landscapes are important tangible reminders of this Nation's rich and diverse cultural heritage. Yet population shifts, urban growth, and energy development place great stress on these unique, nonrenewable cultural resources. This assessment provides Congress with specific information on preservation technologies that could be used to reduce these stresses.
- *Serious Reduction of Hazardous Waste*: Since 1983, OTA has been helping Congress examine the problems associated with *cleanup* of hazardous wastes. Now Congress is turning its attention to *preventing* hazardous waste problems by cutting down on the generation of hazardous waste at its source through innovative engineering and management. This report explored the meaning and consequences of giving primacy to waste reduction over waste treatment, and puts waste reduction squarely into the context of industrial production and efficiency, recognizing the current constraints of the American economy.
- *Alternatives to Animal Use in Research, Testing, and Education*: Between 17 million and 22 million animals are used annually in U.S. laboratories, and public interest in animal welfare has sparked an often emotional debate over such uses of animals. In this assessment, OTA analyzed the scientific, regulatory, economic, legal, and ethical considerations involved in alternative technologies in biomedical and behavioral research, toxicity testing, and education. Congress has recently enacted three laws that deal with laboratory animals, and this report illustrates a range of options for further congressional action.

OTA is also helping Congress foresee new technological challenges and opportunities. Major assessments on new composite materials, biotechnology, infertility treatments, and developments in communication technologies got underway in fiscal year 1986 to pave the way for congressional deliberations in 1987 and 1988 on these highly technical and multi-faceted issues.

OTA is uniquely qualified, by the broad expertise of its in-house staff coupled with an unparalleled ability to tap nationwide sources of information, to assist Congress' efforts both to govern and to apply existing and developing technologies for the good of the Nation. Congress is increasingly inclined to make use of this in-house, nonpartisan resource as scientific and technological issues become more prevalent in legislative debates. I am proud of the job the Office has done in the past year, and anticipate a continuing, steady increase in the number of committees served by OTA and in requests for both full assessments and special analyses.

TAAC CHAIRMAN'S STATEMENT—WILLIAM J. PERRY

The Technology Assessment Advisory Council reviewed four of OTA's nine programs this year and were impressed not only with the high quality of OTA's staff, but also with the obvious esprit de corps of the agency. OTA reports merit the excellent press coverage and several awards they have received.

Science Policy: OTA is beginning to play an important role as a focus for the analysis of science policy. We urge OTA to make use of the voluminous data available in the executive agencies to illuminate the difficult issues of science policy confronting Congress and the Nation.

Global Resources: In repeated studies OTA has effectively explored the issues underlying the sustainability of worldwide agriculture and forestry over the next several generations. We strongly encourage OTA's continued effort to address these issues both from the perspective of classical return on investment and from the perspective of preserving resources for future generations.

Health: OTA has found itself in the middle of politically sensitive health issues such as agent orange, indian health, and cost versus quality in health care. We are impressed with OTA staff skill in the analysis of issues with both scientific and social/political components.

Communication and Information Technologies: OTA has produced a study of intellectual property that provides a starting point for any serious thinking about improvements in the current legal framework. The issues here are both difficult and fundamental, since modern information technology was hardly conceivable at the time the U.S. Constitution and Bill of Rights were framed.

Finally, I would like to add my own regard for the thorough job that OTA continues to do in defense analysis. OTA has carefuly analyzed the technical options for NATO defense in its recently published *Technologies for NATO's Follow-On Forces Attack Concept.* I look forward to the full study, projected to be published in the winter of 1987.

To sum up, TAAC has found little to criticize and much to admire in OTA's work this year. The agency has come of age and has a capability to tackle virtually any thorny policy issue with a scientific content of interest to Congress. There is a danger, however, that OTA could be overextended by the numerous and detailed requests for analysis that come from Congress. OTA should work carefully with the Technology Assessment Board to guard against an undesirable diffusion of its efforts.

DIRECTOR'S STATEMENT—JOHN H. GIBBONS

People have long had a love-hate relationship with the accelerating pace of scientific discovery and the changes such discoveries create in society. When Henry Adams confronted the dynamo and the profound implications of electric power, "he found himself lying in the Gallery of Machines at the Great Exposition of 1900, his historical neck broken by the sudden irruption of forces totally new." In the early 1970s, Alvin Toffler labeled this human response to overstimulation by the high rate of scientific discovery and new technology "future shock." Soon afterward, Daniel Bell noted that while Mendel's first genetic experiments did not begin until the mid-19th century, it was only half a century between diffusion of those results and Pauling's discovery of the molecular architecture of genes, and then only a decade before Watson and Crick discovered the double helical structure of the DNA molecule. The accelerating *pace of change* sometimes seems to surpass the capacity of society to accommodate positively.

Yet it can be argued that the importance of the technological revolution pales beside the disruption in social structures that has accompanied diffusion of those developments. Daniel Bell[1] believes that "the claim of being new is the distinctive hallmark of modernity, yet many of these claims represent not so much a specifically new aspect of human experience as a change in scale of the phenomena . . . the revolutions in transportation and communication which have banded together the world society have meant the breakdown of older, parochial cultures and the overflowing of all the world's traditions into a new, universal container, accessible to all and obligatory upon all." From this perspective, the advance of science and technology inexorably erases traditional boundaries that used to buffer the interactions between individuals, families, and nations. Disappearance of these limits—scale change—places new demands on governance, and traditional and treasured notions of freedom and privacy are sorely stressed.

These two perspectives—of a change of pace and a change in scale—are complementary, for, as Toffler noted, technology encompasses both scientific discovery and diffusion of the practical applications of that discovery. Our society recognizes that good governance requires an ability to accommodate swiftly to technological change and to the changes in social and cultural values it engenders. I believe this fact deeply influenced OTA's founders, as evidenced, for example, in a statement by the late Congressman Charles Mosher:

> Nearly every congressional committee today is forced to make extremely important decisions which include significant technology components, and that will be increasingly so as we move ahead. We increasingly contemplate projects that require huge expenditures of public funds, prospects that would have huge social, environmental, health, or economic impacts, not very readily evident to us. There is, therefore, a crucial need that we know better and assess more accurately those impacts, before we vote our decisions. We can accomplish that effectively only by the use of highly competent skilled systems analysis techniques—supplementing the common horse sense and practical instincts on which we traditionally depend.
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> —118 Cong. Rec. 3202-03, Feb. 8, 1972

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[1] *The Coming of Post-Industrial Society: A Venture in Social Forecasting* (New York: Basic Books, 1973).

Congress saw a threat to the balance of power in our traditional form of government in the deluge of technological proposals sent to it by an executive branch resplendent in scientific resources while Congress remained ill-equiped to evaluate those proposals. Thus, creating OTA was a step toward matching changes in governance to the changes—both in *pace* of life and *scale* requirements—wrought by technology.

In response to its designated role, OTA in fiscal year 1986 released over 40 documents designed to help meet Congress' need for technical analysis. OTA addressed several issues under continuing debate, including biotechnology, acid rain, and industrial competitiveness, and delivered several reports that affected new legislation. The following paragraphs briefly describe a few of these studies.

- Ballistic missile defense and anti-satellite technologies are matters of critical concern for Congress at this time. The Strategic Defense Initiative (SDI) will cost billions of dollars for research, and hundreds of billions more if implemented. OTA's two published reports on this issue may aid Congress with the complex decisions required regarding the nature and timing of this research. Confidence in OTA's ability to provide unbiased, expert analysis of SDI and its associated technologies, and to manage highly classified information, was confirmed in the 1986 congressional mandate for OTA to continue this analysis.
- OTA's major assessments on hazardous waste contributed substantially to national policy aimed at increasing environmental protection while avoiding excessive costs to the private sector. All three major substantive themes of the recent RCRA amendments (i.e., expansion of the regulated universe, limits on land disposal and use of alternatives, and promotion of source reduction) were supported by OTA's work. The reauthorization of Superfund includes proposals that are directly related to findings and options in the OTA reports, such as use of a waste-end tax, establishment of a technology demonstration program, increased R&D support, technical assistance grants to communities, and fostering alternatives to land disposal.
- OTA's technical memorandum on the Federal response to AIDS became the basis of hearings and continuing oversight of the activities of the Public Health Service by the House Committee on Energy and Commerce and the House Committee on Government Operations. Both Committees cited the report as an "invaluable resource document."
- Testimony, briefings, and the OTA report, *Technology, Public Policy, and the Changing Structure of American Agriculture*, were used by the Senate Committee on Agriculture, Nutrition, and Forestry, and the House Committee on Agriculture, to develop agricultural policy in the 1985 Farm Bill. Several provisions of the public law, as passed, are directly attributable to OTA's work. Language in the act also requested that OTA follow up with a study (now underway) of the impact of grain quality on U.S. agricultural competitiveness.
- Safe transportation of the 4 billion tons of hazardous commodities and radioactive and chemical wastes shipped annually in the United States is a concern and responsibility at all levels of government. This assessment suggested alternatives for improved management of hazardous materials transportation and developed a range of policy options for Congress to consider. One of these options, to establish a national, single-license program for commercial vehicle drivers, was adopted in legislation passed at the close of the 99th Congress. This study also influenced new legislation on community right to know and emergency planning.

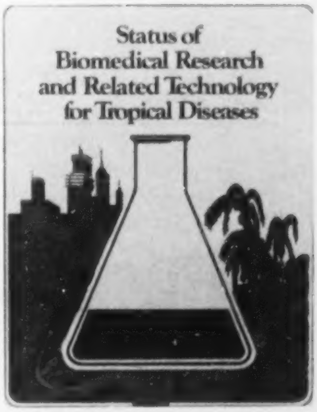
- OTA's report on *Electronic Surveillance and Civil Liberties* pointed out that technology had outgrown the coverage of existing legislation. OTA identified data communications and electronic mail, cellular telephones, and the changing concept of common carriers as issues that might benefit from legislative attention. The report played a fundamental role in informing the debate on the Electronic Communications Privacy Act of 1986, which passed at the close of the last session.

History is replete with tales of stress-created changes in the established order caused by introduction of new ideas or technologies. A healthy state of tension and testing between innovation and the status quo benefits our Nation, but Congress must be prepared to act for the collective good when faced with the societal impacts of new and powerful technologies. Congress must also be in a position to anticipate, cultivate, and prepare wisely for the advent of new technologies. OTA identifies means of accommodation to the impacts—good and bad—of technology-driven change in pace and scale, thereby assisting Congress' choice among the various paths available to productively match governance to a changing society.

Section II.—Year in Review

The assessments carried out by OTA cover a wide spectrum of major issues that Congress and the country are facing. A brief summary of each report published by the Office during the year* is presented in this section. The reader is cautioned that these are synopses of reports. They do not cover the full range of options considered or all of the findings presented in any individual report.

Status of Biomedical Research and Related Technology for Tropical Diseases



The potential for developing technologies to control diseases that threaten more than a billion people in less developed, tropical areas of the world has never been so great. But in recent years, the U.S. Government has devoted less than $100 million annually to biomedical research on these diseases out of a total annual biomedical research budget of well over $4 billion. The small amount of money spent by the U.S. Government appears to reflect choices in policy and not a research field devoid of promise.

In tropical areas, one-tenth of the average person's life is disrupted by ill health. Life expectancy at birth is nearly 20 years shorter than in developed countries. As many as 2 of every 10 babies die before their first birthday. Several hundred million people are infected with parasitic organisms that cause chronic, disabling, and often life-threatening diseases. About 5 million U.S. citizens risk contracting a tropical disease each year, including military personnel abroad, employees of international aid and development agencies and of multinational corporations, and travelers to the tropics.

OTA examined U.S.-funded biomedical research and the current control measures available for 10 diseases that cause extensive morbidity and mortality in the tropics: malaria, schistosomiasis, trypanosomiasis, filariasis, leishmaniasis, leprosy, tuberculosis, diarrheal diseases, acute respiratory infections (ARIs), and certain viral infections. The first six have been singled out as important research targets by the World Health Organization/U.N. Development Program/World Bank Special Programme for Research and Training in Tropical Diseases.

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*Fiscal year 1986 (October 1985 to September 1986).

OTA assessed the biomedical technologies that could contribute to controlling each of these 10 diseases: immunization, diagnosis, medical therapy, and control of vectors (organisms that transmit disease). In many cases, specific controls are lacking, inadequate, or economically out of reach of the countries that need them.

Two of the most important examples of recent progress against tropical diseases are highlighted in this report: progress toward a vaccine against malaria and the development of oral rehydration therapy (ORT) for episodes of diarrhea. The developing malaria vaccine is a product of the explosive growth in the use of biotechnology and new techniques in immunology. If successful, the malaria vaccine could prevent many of the estimated quarter of a billion annual cases of malaria. ORT, developed as a result of basic research in human physiology, could significantly alter the mortality statistics of developing countries, where diarrheal diseases may cause one-third of all infant deaths.

ORT and the malaria vaccine progress illustrate the potential for modern and traditional research methods to change the deadly course of some tropical diseases. The malaria vaccine also illustrates the importance of resources: in 1981, about 10 percent of all U.S. tropical disease research funding went toward the malaria vaccine. Given current funding levels, the potential for advances in other diseases is likely to be realized in very few cases.

Vaccination probably has the greatest potential to prevent illness and death, however there are no vaccines against human parasitic diseases and only a few against viral and bacterial diseases. Using biotechnology, scientists can decipher genetic codes and pinpoint the proteins that trigger immune responses, offering the possibility of safer and more effective vaccines.

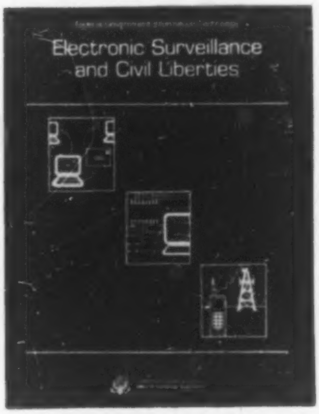
Lack of adequate diagnostic technologies hampers the study and treatment of many tropical diseases. Although conventional diagnostic tests are adequate for some diseases, rapid tests that do not require sophisticated laboratory equipment would benefit patients and provide researchers tools for studying the natural history of diseases.

Research and development in therapeutic technologies continue to lag. Few new drugs have been introduced for human tropical diseases in the past two decades, although there has been a surge in the development of products for parasitic infections of domestic animals. In addition, the available drugs are losing ground to disease organisms that have become resistant. Drug-resistant malaria has now been reported from nearly all parts of the world.

Pesticides, even DDT, still have a place in vector control, but no single technology is likely to be successful against most vectors. "Integrated pest management" may provide the long-term solution, though as yet successes are few in this rather new field.

Electronic Surveillance and Civil Liberties

In the last 20 years, a virtual revolution in electronic technologies has greatly increased the technical options for surveillance activities. Laws protecting civil liberties have not kept pace with these rapid advances. At the same time, law enforcement and investigative agencies, at least at the Federal level, are making significant use of current electronic surveillance techniques and are planning to use many of the new ones.



Based on a survey of Federal agencies (excluding foreign intelligence and counterintelligence agencies), OTA found that about 25 percent (35 out of 142) of Federal agencies responding indicated some current and/or planned use of various electronic surveillance technologies. About 25 percent (36 out of 142) of Federal agencies also report use of computerized record systems for law enforcement, investigative, or intelligence purposes. These include a total of 85 computerized systems with about 288 million records on 114 million persons. Department of Justice agencies alone report 15 systems with, collectively, about 241 million records on 87 million persons.

In 1968, Congress passed Title III of the Omnibus Crime Control and Safe Streets Act to protect the privacy of wire and oral communications, while attempting to strike a balance between civil liberties and the needs of law enforcement and investigative authorities. At that time, electronic surveillance was technically limited primarily to simple telephone taps and concealed microphones (bugs). Now, closed circuit television, electronic beepers and sensors, and advanced pen registers (that record information such as phone numbers and locations dialed) are being used to monitor many aspects of individual behavior. In addition, new electronic technologies used by individuals, such as cordless phones, electronic mail, and pagers, can be easily monitored for investigative, competitive, or personal reasons.

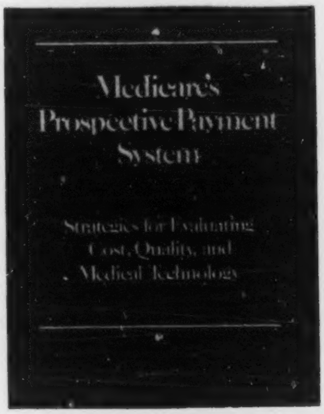
OTA found that: 1) the contents of phone conversations transmitted in digital form or calls made on cellular or cordless phones are not clearly protected by existing statutes, nor are data communications between computers or digital transmission of video and graphic images; 2) electronic mail messages can be intercepted at several stages, and existing law provides little or no protection; 3) legislated policy on electronic surveillance, whether physical or visual, is either ambiguous or nonexistent; and 4) policy on data base surveillance (i.e., monitoring transactions in computerized record systems) is unclear.

OTA identified a range of policy options for congressional consideration:

1. Congress could choose to leave policymaking up to the development of case law and administrative discretion. However, this would continue the uncertainty and confusion as to the privacy accorded to phone calls, electronic mail, data communication, and the like. It ignores judicial requests for clarification in areas such as electronic visual surveillance.
2. Congress could bring new electronic technologies and services clearly under Title III of the Omnibus Crime Control and Safe Streets Act by, for example:
    - treating all telephone calls similarly in protecting against unauthorized interception, whether analog or digital, cellular or cordless, radio or wire, and whether service is provided by common or private carrier;
    - legislating statutory protections against unauthorized interception of data communications;
    - legislating the same degree of protection for all stages of the electronic mail process as for conventional first class mail; and
    - subjecting electronic visual surveillance to a similar or higher standard of protection than currently exists for bugging and wiretapping.
3. Congress also could set up new mechanisms for control and oversight of Federal data base surveillance by, for example:
    - requiring congressional approval of specific Federal data base surveillance applications (e.g., by statutory amendment or approval of House and Senate authorizing committees); and
    - establishing a data protection board to administer and oversee general statutory standards for creating and using data bases for surveillance.

Medicare's Prospective Payment System: Strategies for Evaluating Cost, Quality, and Medical Technology

In creating the Medicare program 20 years ago, Congress made a major commitment to securing older Americans' access to medical care. Medicare has successfully reduced financial barriers to health care for its beneficiaries, but its costs have risen rapidly.



Medicare's
Prospective Payment
System

Strategies for Evaluating
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Medical Technology

In 1983, Congress radically changed Medicare's hospital payment system in an effort to control Medicare expenditures for inpatient hospital services. Cost-based reimbursement was replaced by a prospective payment system (PPS) based on fixed per-case payments for hospitalized patients in 468 diagnosis-related groups (DRGs). Medicare's new hospital payment system reverses the financial incentives away from the provision of more care for hospitalized patients to the provision of less care. Now the question is how this radical change in financial incentives will affect patient care and health care costs.

PPS creates financial incentives for hospitals: 1) to reduce the per-case cost of inpatient care by reducing the length of patients' stays and staff-patient ratios, 2) to increase the number of admissions, and 3) to expand operations into the delivery of services not subject to the constraints of the new system. Since the effects of PPS on the behavior of providers and patients cannot be confidently predicted, a strategy is needed for tracking and evaluating the effects of PPS as they occur.

Evidence on the effects of PPS to date is scanty and pertains primarily to the use of inpatient services. The average length of stay of Medicare patients in short-stay hospitals dropped 7.1 percent per year between 1982 and 1984. Cutbacks in hospital staffing have been reported nationwide. The number of full-time equivalent employees in American hospitals declined by 2.2 percent between May 1983 and May 1984. Although PPS is not the sole cause of these changes, it is almost certainly a contributing factor. Contrary to expectations, the number of Medicare admissions to short-stay hospitals declined, rather than increased, during the first year of the program. How these changes in the utilization and organization of health care affect patients' health remains unclear.

OTA identified the potential impacts of PPS on five critical dimensions of health system performance: expenditures and costs, quality of care, access to care, technological change, and clinical research. In each area, OTA predicted the directions of change that could be expected from the incentives of PPS. OTA then identified specific questions that require study if Congress and the public are to be able to judge the impacts of PPS. Specific studies were developed as options in each area.

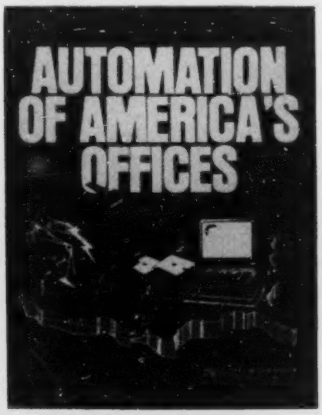
OTA emphasized that a strategy for evaluating PPS impacts should include specific plans for identifying and tracking its effects on the most vulnerable Medicare beneficiaries. Three groups that may be particularly vulnerable to restricted access or reduced quality of care are very old people, alcoholic and mentally ill patients who are hospitalized for other conditions, and disabled people. Certain other classes of beneficiaries, as defined by socioeconomic status, race, or particular diseases, may also be vulnerable.

Evaluating the effect of PPS on vulnerable groups is critical but it is insufficient. Equally important in the long run is the development of plans for a balanced assessment of the full range of PPS effects, positive as well as negative. Furthermore, evaluations need to include detailed analyses of how changes in the use and organization of health care services ultimately affect the benefits and costs of health care.

The link between changes in the health care system and the PPS is difficult to measure because PPS is not the only change underway in the health care system. Simultaneous changes in the supply of physicians, competition in health care, and other changes in Federal and State Health Policy—along with changes in the health and age of the American people—limit researchers' ability to attribute many changes directly to PPS.

The funds and personnel necessary for conducting a comprehensive evaluation of PPS are unavailable within any Federal agency, including the Health Care Financing Administration, which has a congressional mandate to prepare annual reports on PPS impacts. In addition, the lack of timely data severely impedes the evaluative process. Both the organization of PPS evaluation and the databases required to carry out evaluations could be enhanced by the designation of one Federal agency to coordinate and oversee the Federal PPS evaluation.

Automation of America's Offices



America's offices are rapidly becoming automated; the promise of large gains in worker productivity and the creation of new services and products is affecting all industry sectors. Automation is likely to slow and possibly halt the growth in office employment. It also changes the nature of office work—it requires new skills and changes in the way work is organized and managed. Organizations will need to reexamine their policies related to hiring, job classifications, promotion paths, training, salaries, and fringe benefits. Federal, State, and local governments will need to reexamine and vastly improve their capability to understand and deal with these structural shifts in society.

Office employment has grown faster than other kinds of employment in the past century. Today, 90 percent of people in the insurance and banking industries, 80 percent of Federal workers, over half of employees in service industries, and nearly 30 percent of manufacturing employees are office workers.

By 1990, one out of three office workers will probably use a computer terminal; and by 2000, terminals may be as commonplace on office desks as telephones are today. The automation of office work will accelerate over the next decade as the cost of computer equipment falls and organizations seek ways to reduce labor costs.

Productivity gains are likely to be large as automation shortens the time required to do many tasks and removes the need for people in other tasks. These productivity gains will not be one-time benefits but will be continuing and cumulative as automated offices network with automated suppliers and customers.

Clerical jobs are most likely to be affected by the slowing of growth in office jobs, especially as new technologies sharply reduce the need for keyboarding. But lower and mid-level management positions and some professional occupations will also be affected. Use of temporary, part-time, and home-based employees or contractors is likely to expand, increasing the proportion of the work force without basic employee benefits and security. A growing number of firms may relocate data-entry operations to other countries to further reduce labor costs.

In the Federal Government, which is generally keeping pace with the private sector in office automation, reduction in clerical work will tend to decrease the number of workers at lower grade levels and raise the average grade level. If the grade level is artificially held down, recruitment of highly qualified people into the civil service will be more difficult.

Automation has also raised concerns about the health effects of concentrated work at visual display terminals (VDTs). Complaints of musculoskeletal and visual strain increase as offices are automated, but these problems can be alleviated. Concerns about reproductive hazards can be neither substantiated nor fully refuted with existing data; they merit further research and monitoring. The faster pace of automated work and the workers' loss of control over that pace can increase mental stress, which at high and sustained levels can lead to chronic illnesses.

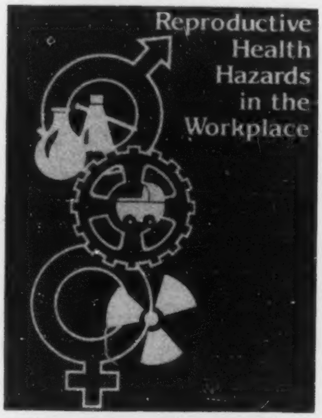
These various changes and problems are of particular concern to women and to members of minorities, who are now concentrated in lower level jobs most likely to be adversely affected.

Attention to current and potential problems is important but should not obscure the promise of office automation to increase productivity and generally improve the quality of white-collar worklife. However, government needs to vastly improve its capability of providing decisionmakers in both the public and the private sector with better technological and employment data, forecasts, and analysis.

OTA's report summarizes case studies of office automation in both private corporations and government agencies, to provide examples of the opportunities and problems that come with office automation.

Reproductive Health Hazards in the Workplace

Management of workplace risk to reproductive health presents increasingly complex choices to employers, workers, and legislators. Although the rapid influx of women into the labor force has heightened concern that workplace hazards may impair their ability to bear healthy children, male workers may be at equal risk of harm to their reproductive and procreative capacity.



Reproductive dysfunction is a significant health problem in the United States. Unintentional infertility affects more than 8 percent of American couples of childbearing age and various congenital malformations are diagnosed in 7 percent of U.S. infants. But it is not yet possible to determine whether and to what extent reproductive health impairment results from occupational exposure to harmful agents. There are two reasons for this situation: 1) reproductive impairment, per se, is difficult to measure in either an individual or a population; and 2) little is known of the reproductive effects of many suspected hazards.

Evidence linking specific agents with reproductive or developmental effects in humans is, for the most part, inconclusive. However, four hazards are now regulated in part because of their known effects on adult reproductive capacity or embryo/fetal development: 1) ionizing radiation, 2) lead, 3) ethylene oxide (EtO), and 4) dibromochloropropane (DBCP). Agents associated in varying degrees with impairment of reproductive function include other chemicals; nonionizing radiation; physical factors (e.g., hot, cold, hyperbaric or hypobaric environments, noise, vibration); infectious agents; lifestyle factors (e.g., alcohol and tobacco use); ingestion or absorption of certain drugs; and overexertion and stress.

Among the factors complicating the study of reproductive health hazards are individual variation in susceptibility to suspected agents, difficulties in extrapolating information from animal studies, and incomplete data on the agents, their possible toxic effects, and the numbers of workers exposed to them. **Many of the agents that have been studied for these effects have been evaluated only in men, women, or offspring, but not in all three.**

Although policymakers, employers, and scientists may never know the full extent of reproductive health impairment or completely understand its causes, the Federal Government, by law, must ensure that employers provide as safe a workplace as feasible, and enforce the statutory right to equal job opportunities and security for men and women.

Development of equitable policies for managing reproductive risk is complicated by the differing impacts of exposure on women, who are born with a finite supply of egg cells; on men, who produce sperm cells throughout life; and on their offspring, who can be harmed by hazardous exposures to their mothers during pregnancy or to either parent prior to conception.

In addition, workers are concerned that preventive actions by employers could limit job opportunities and security, as in the case of fetal protection policies (FPPs) that can discriminate against women workers. Where employment policies based on differential exposure standards for men and women are not substantiated by scientific evidence, they create liability for sex discrimination under Title VII of the Civil Rights Act of 1964.

Protection of reproductive health in the workplace depends primarily on adequate engineering and exposure controls, education programs, and personal protective equipment. If these measures fail and workers are harmed, compensation becomes the issue. **In most cases, workers' compensation does not cover reproductive harm, and workers usually cannot seek redress against their employers in court.**

In addition to maintaining the status quo, Congress has a number of options for protecting the health of workers and their children while also protecting employment rights. Congress could:

Protection of reproductive health in the workplace depends primarily on adequate engineering and exposure controls, education programs, and personal protective equipment. If these measures fail and workers are harmed, compensation becomes the issue. **In most cases, workers' compensation does not cover reproductive harm, and workers usually cannot seek redress against their employers in court.**

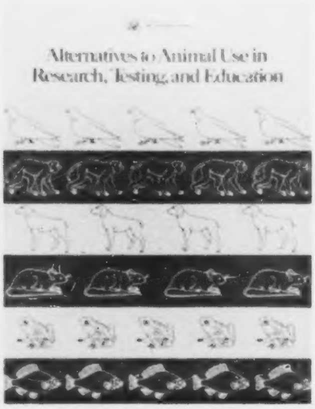
In addition to maintaining the status quo, Congress has a number of options for protecting the health of workers and their children while also protecting employment rights. Congress could:

- Require scientific evidence that no harmful effects are transmitted from the exposed father to the offspring as a basis for discriminatory FPPs; require employers to allow workers to leave hazardous jobs temporarily without economic loss; or amend Title VII to allow FPPs that treat male and female workers differently when scientific evidence is inconclusive. This latter action would, however, fail to account for the possibility of fetal damage resulting from hazardous exposure of either parent before conception and could result in discrimination against women workers.
- Instruct regulatory agencies to be more willing to assume that an exposure is dangerous when only a small number of studies suggest this. Congress also could amend the Occupational Safety and Health Act (OSH Act) to permit employees to take legal action against employers who are suspected of violating regulations. Congress could also amend the "grave danger" language of the OSH Act to allow the Occupational Safety and Health Administration (OSHA) to respond more quickly to risks by issuing emergency temporary standards under less rigid constraints.
- Join OSHA and the National Institute for Occupational Safety and Health (NIOSH) organizationally to increase coordination of priorities, or require OSHA to respond to NIOSH recommendations concerning reproductive and other occupational health hazards.
- Enact a Federal statute or encourage State legislatures to add specific provisions to workers' compensation systems covering reproductive health impairment, or to provide the right to pursue tort remedies for injuries not compensated.

In addition, **congressional oversight of research priorities and scientific standards could promote better understanding of the nature and extent of risks, technical advances to reduce risks, and the actions necessary to protect workers.**

Alternatives to Animal Use in Research, Testing, and Education

For most areas of scientific experimentation, totally replacing animal use with nonanimal methods, especially in the short term, is not likely. More likely prospects are reducing the number of animals used and making procedures more humane.


Alternatives to Animal Use in Research, Testing, and Education

OTA reviewed alternative technologies to animal use in three areas: **research** in biomedicine and behavior, **testing** for toxicity, and **education** in the life sciences. **Alternatives vary according to the different uses of animals in each area.**

Research, and to a lesser degree, testing, will continue to require live animals for observing complex interactions of cells, tissues, and organs. In **testing,** some whole animal methods are being replaced by nonanimal methods, as the new tests are validated. Federal regulatory agencies have recently indicated a willingness to accept data from alternative test methods. Chick embryo membranes, for example, are a promising alternative to rabbits' eyes for determining irritancy of chemical substances. Other test methods use cells, tissues, and organs in culture, and chemical and physical models. In **education,** far fewer animals are used than in research or testing, yet animal use in the classroom plays an important role in shaping positive attitudes about living animals.

Although the Federal Government supports areas of research and testing that generate alternative technologies, it has not directed funding towards the development of alternatives per se. **Research areas most likely to contribute to alternatives include cell-, tissue-, and organ-culture technology; animal health; understanding mechanisms of pain, pain control, and pain perception; and computer simulation of living systems.**

For example, **computer simulations of living systems** can replace or complement some animal use, especially in education. However, use of animals is a prerequisite to the development of ever more sophisticated simulations. Computerized dissemination of research and testing results also could reduce some animal use.

Although reduction in numbers of animals used is also a principal alternative, data currently available on animal use are very poor. Any estimate of animal use is a rough approximation. The best available data suggest a minimum of 17 to 22 million animals are used annually in the United States. Included in these figures are 12 to 15 million rats and mice. Current data permit no statement about any trend in animal uses through recent years.

Ethical considerations are affecting the search for alternatives. The principle of humane treatment provides common ground for all, despite disagreement on exactly how the principle should be interpreted and applied. At one end of a broad spectrum is the view that humans may use animals in any way. At the other end is the view that an animal has the right not to be used for any purpose not directly benefitting it. Most parties agree that action to conserve animals is part of humane treatment.

Federal regulation of animal use in research and testing facilities occurs chiefly under the Animal Welfare Act, the Health Research Extension Act, rules of the Environmental Protection Agency and the Food and Drug Administration on good laboratory practices, and the policies of the Public Health Service and the National Institutes of Health.* The Animal Welfare Act is applied to dogs, cats, rabbits, guinea pigs, hamsters, and nonhuman primates, but not to rats and mice, the most common laboratory animals. Most **State laws** focus on matters such as procurement of animals rather than the actual conduct of experiments. **Institutional and self-regulation** occur via local **review committees** that include lay members and whose purview is expanding beyond traditional concerns of animal care to include aspects of animal use. **The overwhelming majority of animal users are (or will soon be) subject to local committee oversight.**

For this study, **OTA defines animals as nonhuman vertebrates: mammals, birds, reptiles, amphibians, and fish.** Other creatures customarily included as animals--invertebrates such as insects and worms—are excluded by this definition. OTA did not examine animal use in food production; harvesting organs, antibodies, and other biological products; and sport, entertainment, and companionship.

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*In 1985, Congress enacted three laws citing alternatives to animal use; the Health Professions Educational Assistance Amendments of 1985, the Health Research Extension Act of 1985, and the Food Security Act of 1985, which Amended the Animal Welfare Act.

Technology and Structural Unemployment: Reemploying Displaced Adults

TECHNOLOGY AND
STRUCTURAL UNEMPLOYMENT:
REEMPLOYING DISPLACED ADULTS

Millions of American workers are losing their jobs each year because of structural changes in the U.S. and world economies. Some of them—especially younger workers with skills in demand or the right educational background—get right back to work in new jobs. Others remain out of work for months, even years. Many of the displaced are middle-aged unskilled or semiskilled manufacturing workers, with long and stable job histories. **Mechanisms for worker adjustment—such as job training programs and education for adults—have not kept up.**

Over the 5 years from 1979 to 1984, 11.5 million American workers lost jobs because of plant shutdowns or relocations, rising productivity, or shrinking output, according to a 1984 survey by the U.S. Bureau of Labor Statistics (BLS). In 1984, one-quarter of those who had held their previous jobs for 3 or more years were still unemployed. **Of those who found new jobs, at least half took cuts in earnings.**

Although manufacturing now accounts for less than 20 percent of U.S. employment, **nearly half of all workers displaced from 1979 to 1984 worked in manufacturing industries, especially those hard hit by international competition.** The service jobs that the U.S. economy has created in the past few years are not equivalent to the old manufacturing jobs. The pay is not as good (average hourly pay in the service sector was $7.52 in 1984, compared with $9.18 in manufacturing), and the better service jobs require skills or education that most displaced workers do not have.

Given the incentives leading U.S. firms to invest overseas and take advantage of cheap labor, or to use less labor at home, displacement is bound to continue. **Manufacturing jobs—especially production jobs—probably will continue to decline. Within manufacturing, the most vulnerable jobs are those of unskilled and semiskilled production workers.** These jobs are not only the easiest to automate, they are also the easiest to move overseas. In all sectors of the economy, service as well as manufacturing, manual labor and routine mental tasks are vulnerable to computer-based technology.

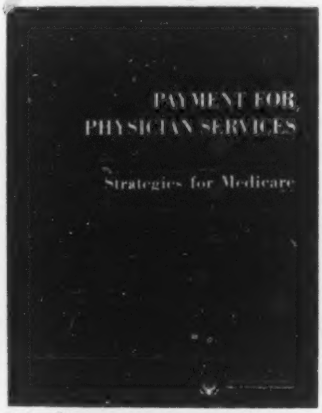
The Federal Government has supplemented its traditional employment programs with new assistance for displaced workers, mainly through Title III of the Job Training Partnership Act of 1982 (JTPA). Reports on the first 2 years of operation show that JTPA programs are helping displaced workers find new jobs. **However, it is likely that**

no more than 5 percent of those eligible are being served. It appears that vocational skills training is not strongly emphasized. Retraining in basic educational skills is mostly neglected, although about one-fifth of all adult workers probably need improvement of their basic skills to get jobs with good possibilities for advancement. **To help provide the skilled work force that American industries need to maintain competitiveness in the world economy, the program will have to reach many more displaced workers, and emphasize training—particularly basic skills training—more strongly.** Educational technologies offer considerable promise in helping adults overcome basic skills deficiencies.

Another group of displaced people, with especially difficult problems of finding adequate jobs, is displaced homemakers. These are women whose main job has been home and family, but who now must support themselves because of divorce, widowhood, disability, or long-term unemployment of their spouse, or loss of eligibility for public assistance. **The population of displaced homemakers is 2.2 to 4 million, and the number is growing.** Federal assistance to displaced homemakers recently was substantially increased in the Carl D. Perkins Vocational Education Act of 1984. Yet support for the programs serving this group is still small in relation to their numbers. **Barriers to employment are higher for displaced homemakers than for mainstream displaced workers.**

Policy options include congressional actions that could bring prompt effective services to workers in plants that are closing, enhance both vocational and basic education and training in JTPA and other programs, improve delivery of assistance to displaced homemakers, improve labor market and occupational information, encourage employers to offer workers chances at both vocational and basic education while they are still employed, and emphasize research on the effects of technological change on jobs.

Payment for Physician Services: Strategies for Medicare


PAYMENT FOR PHYSICIAN SERVICES

Strategies for Medicare

Medicare expenditures for physician services are one of the fastest growing components of the Federal budget. During the 1980s, total Medicare expenditures for physician services rose an average of 16 percent per year, reaching an estimated $19 billion in fiscal year 1985. Unless steps are taken to moderate it, similar growth (14 percent per year) is expected through fiscal year 1990. Most of the annual increase in aggregate Medicare expenditures for physician services over the past decade has been due to higher prices for services (48 percent) and more services per beneficiary (39 percent); only 13 percent has been due to increases in the number of beneficiaries. Since 1978 and especially since 1982, Medicare per capita expenditures for physician services have risen more rapidly than overall U.S. per capita physician expenditures.

Medicare's payment policies play an important role in rising program expenditures for medical care. Like many other payers, Medicare pays physicians and certain other providers a fee for each service performed. Fee-for-service payment gives these providers a financial incentive to perform additional services as long as the additional revenue exceeds their costs. Because medicine is not an exact science, physicians have much opportunity to exercise discretion and recommend additional visits or procedures within the bounds of accepted medical practice.

Moreover, Medicare's method of determining payments to physicians is inherently inflationary. Under Medicare's customary, prevailing, and reasonable (CPR) charge-determination process, payments are based on what physicians have charged in the past. Medicare approved charges to individual physicians are limited by the Medicare Economic Index, but the effect of the index varies by specialty and type of service. Charges for primary care areas, such as office visits, have been more constrained than charges for radiology and general surgery.

Another concern, apart from rising expenditures, is the substantial variation across the country in certain aspects of Medicare payment for physician services. Medicare payment rates for urban, specialist, and inpatient services are typically higher than those for rural, generalist, and ambulatory services, and some observers consider the differentials excessive. Payment rates also tend to be higher for procedural services such as electrocardiograms and surgery, which are heavily dependent on the use of medical devices, than for nonprocedural services such as historytaking and counseling. Differentials in Medicare payment rates for certain services give physicians financial incentives to favor and perhaps overuse the more generously reimbursed services. Assignment rates, the rates at which providers agree to accept Medicare's approved charges as payment in full, have ranged from 17 percent of charges in South Dakota to 87 percent in Rhode Island. These variations may indicate problems pertaining to access to care, quality of care, or efficiency, although there is little consensus about whether specific variations indicate problems.

To help restrain increases in Medicare expenditures for physician services, the Deficit Reduction Act of 1984 froze physician charges to Medicare beneficiaries for 15 months beginning July 1, 1984. The 1984 act also mandated OTA to study alternative methods of paying for physician services under Medicare.

OTA examines four alternative Medicare payment strategies for Congress to consider: 1) modify present payment arrangements, while retaining CPR as the mainstream payment method; 2) base payment on fee schedules, with a predetermined payment rate for each service; 3) explore moving to payment for packages of related services; and 4) adopt capitation payment, a fixed payment per person per month for covered medical care, for all Medicare beneficiaries.

The effects of each strategy are difficult to predict because of uncertainty regarding physicians' behavior and the changing medical marketplace. Capitation payment for all beneficiaries is most likely to be able to control Medicare expenditures without increasing beneficiaries' expenditures. But since techniques for setting capitation rates for different categories of beneficiaries are not well developed, the rate structure could unintentionally contain incentives for capitation plans to seek some beneficiaries as enrollees and to avoid others. Payment based on fee schedules would give Medicare greater control over the prices of individual services, but might not constrain total program expenditures. That would depend on changes in the volume and types of services as prices were more restricted. Lowering Medicare's approved charges or continuing the present freeze on providers' charges under CPR might initially reduce the growth in Medicare expenditures, but this effect would be unlikely to be sustained because of changes in billed charges and in volume and types of services. Payment for packages of services could theoretically enable Medicare to limit expenditures for packaged services, but total expenditures would depend on the extent to which related services were used outside the packages. Moreover, little or no experience exists with payment for packages that include the services of different physicians.

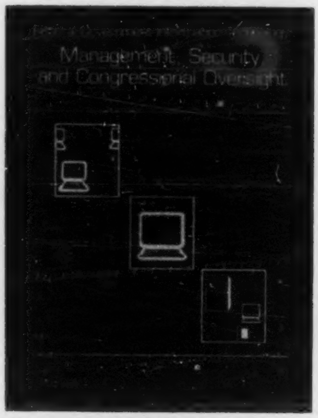
Assuring quality of care is a concern under all the payment alternatives, but the focus of concern differs for specific alternatives—from overuse of services with CPR and other fee-for-service alternatives to underuse of services with payment for packages of services and capitation payment. The effects of payment reform on quality would also depend on the levels of payment and on the extent to which services are now being used appropriately. If lower payment rates and more global payment methods lowered the use of services overused in the past, quality could be improved. On the other hand, quality could decline if lower payment rates led to reductions in necessary services and to delays in diagnosis and treatment.

Specific problems regarding beneficiary groups' access to care have not been documented to date. Assignment rates have been rising since 1976 and reached 67 percent of all charges in fiscal year 1985, the first year of Medicare's participating physician program (under which a physician may agree to accept assignment on all Medicare claims). Assignment rates and beneficiaries' access to care have increased with higher Medicare payment rates and have decreased with lower rates. If Medicare payment rates for physician services were set too low, physicians might increasingly refuse to accept assignment or might try to avoid certain types of cases or beneficiary groups.

However, Medicare payment reform that lowers the level of payment or limits the revenue to providers would encourage the development and use of cost-saving technologies and of less expensive sites of care. Regionalization of expensive technologies would also be expected, perhaps reducing beneficiaries' geographic access. Expensive new technologies, such as magnetic resonance imaging, might be adopted more slowly.

Congress could consider, in addition to the four payment strategies, options to improve controls over the volume of services billed, to reduce differentials in Medicare payment rates for certain services, and to increase assignment rates. These options address issues that have arisen under CPR payment and that would also be of concern under payment based on fee schedules or payment for packages of services, but these options would also be consistent with eventually moving to capitation payment. Another option is for Congress to establish a physician payment commission to examine and help implement alternative payment reforms.

Federal Government Information Technology: Management, Security, and Congressional Oversight



The U.S. Government—the largest user of computer equipment of any single organization or government in the world—is critically dependent on information technology. Improvements in management could give the government a much higher return on its substantial investment in computers, telecommunications, and related personnel and services, conservatively estimated at $60 billion over fiscal years 1982 through 1986.

Rapid advances in technology—such as microcomputers, computer networking and modeling, videoconferencing, and electronic information exchange—have overtaken much of the policy previously established by Congress to control, oversee, and encourage the management and use of Federal information technology. These advances are generating many new uses, opportunities, and issues that need congressional attention.

One cause for concern is inattention to the security of Federal information systems. **Federal agencies are not fully implementing appropriate security measures.** For example, about 40 percent of agencies responding to an OTA survey have not conducted a security risk analysis for at least 5 years, 25 percent do not perform background checks on personnel with access to Federal computer systems containing sensitive information, and about 60 percent do not have and are not developing contingency plans for use if mainframe computers are disrupted. Also, 75 percent of agencies do not have an explicit policy for security of information in Federal microcomputers.

In addition to technical and administrative security measures, protection against computer crime requires criminal laws to provide disincentives for potential violators and facilitate prosecution when crimes occur. Though 45 States have passed computer crime laws, determining appropriate State jurisdiction can be difficult because many computer systems are located in more than one State or use data communication networks that routinely cross State lines. Thus, **extending the existing Federal law to cover interstate computer crime is warranted.**

If the Federal Government is to realize the full potential of information technology for increasing its efficiency and effectiveness, other specific areas need improvement:

- strategic planning for Federal information technology;
- the scope and quality of information available to Congress, and to the agencies themselves, on key Federal information technology trends and applications;

- mechanisms to encourage innovation in use of information technology by agencies;
- procurement of large computer systems;
- evaluation and use of computer modeling to support agency decisionmaking; and
- government foresight, including the monitoring and analysis of longer term trends.

Although many of these needs could be met by the executive branch acting alone, Congress can facilitate, encourage, and, where necessary, require these actions. One vehicle available to Congress is the Paperwork Reduction Act of 1980, which is overdue for reauthorization and could be amended to provide a more detailed congressional mandate.

OTA also identified ways that information technology could improve the collection, maintenance, and dissemination of government information—for example, via interactive data networks, electronic bulletin boards, and electronic printing. **These technologies could revolutionize the public information functions of government.** Further evaluation in this area is needed, and, ultimately, Congress is likely to be called on to update existing public information laws.

Finally, **OTA identified significant unrealized opportunities for congressional use of information technology in conducting oversight,** including: 1) access by congressional committees and staff to agency electronic files, where appropriate; 2) use of computer-based modeling and decision support; 3) video- and computer-conferencing; and 4) electronic tracking of agency and executive actions. Pilot tests are needed to assess the benefits, costs, and problems.

Technology, Public Policy, & the Changing Structure of American Agriculture

Technology, Public Policy, and the Changing Structure of American Agriculture

As America enters the era of biotechnology and information technology, agricultural productivity will increase significantly and the structure of agriculture and of rural communities will change forever. Approximately 1 million farms will disappear between now and the year 2000, mostly moderate-size and small farms. About 50,000 large farms will then account for 75 percent of U.S. agricultural production.

The main beneficiaries of the new technologies will be the operators of large farms. Operators of small and moderate-size farms, the traditional "backbone of American agriculture," will be less competitive, partly because they will be unable to adopt many of the new technologies. Generally, 70 percent or more of the largest farms are expected to adopt emerging biotechnologies and information technologies, compared to only 40 percent for moderate farms, and about 10 percent for the smallest farms.

Increased productivity from emerging technologies will be needed for American agriculture to regain its competitiveness in international trade. If the United States cannot compete with other countries, reduced exports will exaggerate the structural changes that U.S. farmers and rural communities are facing.

Large farm operators naturally tend to concentrate their living and business activities in larger communities. The disappearance of farm operations from small towns will have repercussions on other businesses in rural communities and on the labor pool in general, which must absorb those workers whose livelihood once depended on agricultural production.

Although technology was found to be an important force in changing the structure of American agriculture, it is not the only force. Public policy, institutions, and economics have had and will continue to have important roles in shaping agricultural communities. In particular, if current farm programs of the Federal Government remain in force, they will accelerate these changes in the structure of agriculture and rural communities that support farming.

Farm programs, which include the Commodity Credit Corporation purchases and price and income supports, have major effects on farm size, wealth, and incomes of commercial farmers. The net worth of large farms is increasing significantly more than that of moderate-size farms under current farm programs. Large farms receive a very large proportion of the program payments, although most of these farms would survive and prosper without farm programs.

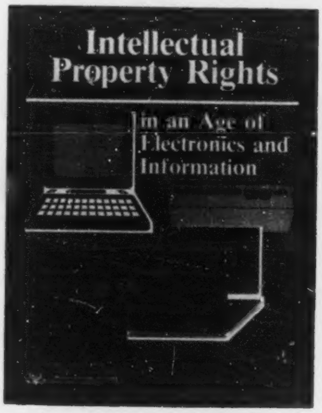
To assure a diverse, decentralized farm structure, where all sizes of farms have an opportunity to compete and survive, different policies and programs would have to be developed for each of the three farm segments—large, moderate-size, and small farms.

- Large-scale farms (above $250,000 in sales) do not need direct Government payments and/or subsidies to compete and survive. Rather, they need a relatively stable economic environment so they can sell what they produce, and they need a base of public and private research whereby they can maintain their competitiveness.
- Moderate-size farms (having $100,000 to $250,000 in sales) require farm programs to survive and be successful. In particular, income supports provide significant benefits to moderate farms. Targeting income supports to moderate farms could prolong their survival. To aid this group, the risk of operating in an open market environment could be reduced, new technologies that have the potential for adoption could be made more available to them, and opportunities for employment outside agriculture could be created for those who are unable to compete. The Extension Service could play a significant role in providing this aid.
- With few exceptions, small/part-time farms (having less than $100,000 in sales) are not viable economic entities in the mainstream of commercial agriculture—nor can they be. However, a small increase in the income of each farm in this group could have a significant multiplier effect on the local economy because of the large number of small farms.

For the small/part-time farmers who either have a substantial outside income or who have found a niche in the market, the Government's role would be severely restricted. However, small subsistence farmers, who have limited resources and often limited abilities, represent a genuine problem for which public concern is warranted. These indeed are the rural people left behind. Price and income support programs can do little to solve their problems. U.S. Department of Agriculture and land-grant universities have a special responsibility to serve their needs.

Intellectual Property Rights in an Age of Electronics and Information

The changes that new technologies are making in the way that information is created, distributed, and used today are as fundamental as the changes made by the printing press. These changes are undermining many of the mechanisms by which the U.S. intellectual property system has operated in the past. Although Congress could make some changes now to relieve immediate problems, over the next 10 years substantial changes in the system will be required if it is to meet its original goals laid out in the Constitution—fostering science and the useful arts and encouraging the dissemination of information and knowledge to the public.



Intellectual Property Rights
in an Age of Electronics and Information

Originally, the implementation of intellectual property law, and particularly copyright law, was relatively simple. The Government granted copyrights to authors and patents to inventors. Rewards were determined in the marketplace. The patent and copyright holders, themselves, monitored infringements and enforced their rights through the courts. Individuals' interests coincided with the public's interest—to profit from copyright, an author had to print his works and sell them; to profit from a patent, the inventor had to disclose his ideas to the public.

Today, technological change is complicating the intellectual property system. The problems raised by computer, communications, and other information technologies include:

- **Authorship:** Copyright law, based on originality of works and individual authorship, may become too unwieldy to administer when works involve many authors, worldwide collaboration, and dynamically changing materials.
- **Enforcement:** Vast amounts of copyrighted materials can be copied, reprocessed and traded without the knowledge or permission of rights holders.
- **Private Use:** Current law is ambiguous about whether private reproduction and transmission of vast quantities of copyrighted works should be allowed.
- **Functional Works:** New kinds of intellectual property that uses information in a process (for example, computer software), which OTA calls functional works, are obscuring the traditional distinction between patentable inventions and copyrightable writings.
- **Derivative Use:** The repackaging of information and creation of new information products, made possible by new technologies,

raises questions about whether the original copyright holder should control all these new uses.

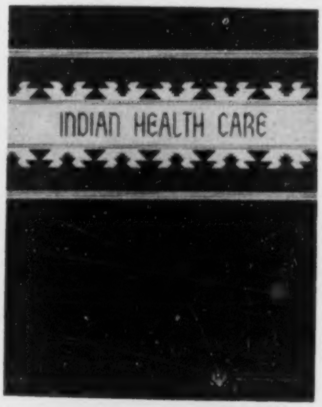
- **Intangible Works:** Electronic distribution of intellectual works may lead to tighter control over public access to information.
- **Educational Goals:** Copyright may fail to meet its intended educational goals because information is increasingly being sold rather than shared, and some of it may become too expensive for educational institutions.
- **Integrity:** New technologies may be used to misrepresent or distort the work of an artist without the knowledge of the original creator.
- **International Coordination:** The globalization of information markets increasingly requires international cooperation in framing intellectual property law and policy.

These problems have no simple answers. A solution to one problem is likely to cause another. Moreover, because technology is spawning many new kinds of intellectual works, a single policy tool, such as copyright law, may be less effective than in the past in meeting policy goals.

Our understanding of how the system now operates is extremely limited and technology is still changing. It is bringing new parties into the intellectual property debate and making information a critical factor for the economy and for society as a whole. Not surprisingly, the decisions that Congress makes about intellectual property policy will affect a broad range of other policy areas: communications, trade and international affairs, privacy, antitrust, education, public information, research and development, and tax policy. In making decisions about intellectual property policy, therefore, Congress will need to take into account new issues and new stakeholders and assure the coordination of policymaking among diverse policy areas.

Given the numerous uncertainties about the intellectual property system and its likely evolution, it is too early to make major revisions in the law. However, if Congress is to devise a sound intellectual property policy for the future, it must begin now to establish a mechanism to collect and evaluate information about how the system works and where it may be heading. Since no government agency is presently constituted to undertake such a comprehensive task, some institutional change is likely to be required.

Indian Health Care



The health of American Indians and Alaska Natives has improved substantially since responsibility for Federal health services to Indians was transferred from the Department of the Interior to the Public Health Service's Indian Health Service (IHS) in 1955, but Indians still lag behind the general U.S. population, and wide variations exist in mortality rates among Indians served by IHS. In 1980-82, the average age-adjusted mortality rate for Indians residing in IHS service areas was 1.4 times that of the general U.S. population, with every IHS area except Oklahoma above the U.S. average. Perhaps the most significant general indicator of Indian health status is that Indians do not live as long as other U.S. populations. In 1980 to 1982, 37 percent of Indian deaths occurred before age 45, compared with only 12 percent of all U.S. deaths in that age group. Despite higher mortality among Indians, they are hospitalized at rates below those of the general U.S. population. Also, although the average age of the Indian population has increased, their hospitalization rates have been decreasing. These findings imply that access to health care for Indians has decreased.

In the 1980 census, 278 reservations and 209 Alaska Native Villages were counted, and 1.4 million persons were self-identified as Indians, Eskimos, or Aleuts. Fifty-four percent lived in central cities or in urban areas. Thirty-seven percent actually lived inside identified Indian areas (e.g., reservations, tribal trust lands). Ten reservations accounted for 49 percent of all reservation residents. Four States had Indian populations in excess of 100,000: California, Oklahoma, Arizona, and New Mexico.

In 1980, the poverty rate for American Indians throughout the United States was 27.5 percent, more than twice the rate of 12.4 percent for the general U.S. population; among reservation Indians, the poverty rate was 44.8 percent. Unemployment rates followed a similar pattern: 13.0 percent for American Indians, 27.8 percent for reservation Indians, and 6.5 percent for the general U.S. population.

Services provided to Indians by IHS are based on the political relationship between the Federal Government and Indian tribes and are not based on racial identity. Thus, IHS services are directed primarily at Indians living on or near the reservations of federally recognized tribes. States that contain one or more reservations of federally recognized tribes are designated as 'reservation States' by IHS, and there were 32 such States as of 1986.

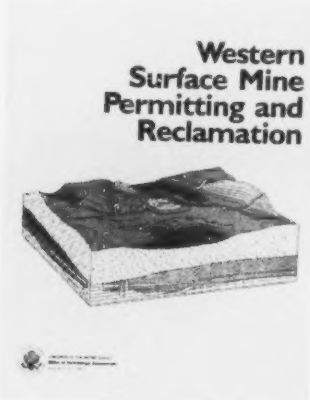
IHS serves an Indian population estimated at 987,000 in 1986. Services that cannot be provided through IHS or tribal facilities are purchased through contracts with non-IHS providers. The availability of health services may vary considerably among IHS service areas. Some areas are more dependent on contract care, with a few areas without IHS or tribal hospitals and therefore dependent on non-IHS hospitals. These areas sometimes are forced to defer or deny needed services because funds for contract care are limited.

Key issues identified in the report include the possibility of redefining which Indians should be eligible for Federal health care; achieving a more equitable allocation of resources among IHS service areas; cost containment, especially in the contract care program; and implementation of self-determination legislation enacted by Congress in 1975, under which tribes are encouraged to assume management of Federal services provided to them.

Indian health programs are partially protected from the Balanced Budget and Deficit Control Act, with reductions limited to 1 percent in fiscal year 1986 and 2 percent in subsequent years. In fiscal year 1985, IHS's total appropriations (excluding facilities' construction) was $807 million, of which $637 million was spent on clinical services, with the remainder spent on preventive health programs and other activities such as urban projects, manpower training, and administrative costs.

The report assembles data from many sources, some of which are not readily available elsewhere. It presents an overview of the Federal-Indian relationship; provides demographic and socioeconomic information on the Indian population; analyzes the health status and health problems of Indians by IHS service areas; and describes the sources of Indian health care, with emphasis on services provided or paid for by IHS.

Western Surface Mine Permitting and Reclamation



Western Surface Mine Permitting and Reclamation

The coal industry has learned much about reclamation in the arid Western U.S. coal fields since passage of the Surface Mining Control and Reclamation Act of 1977 (SMCRA), and the prognosis for the long-term success of the reclamation of Western surface mined lands has brightened considerably. Some significant uncertainties about Western reclamation remain, however. These arise primarily because the unusual geology, soils, hydrology, and ecology of the West limit the ability to predict the impacts of mining and to design reclamation.

For example, the complex geology of some Western coal fields makes it difficult to locate potentially acid-, alkaline-, or toxic-forming strata of rock and other material overlying the coal ("overburden"). These materials could adversely affect postmining water quality or revegetation if they were placed in the water table or root zone when the pit is filled after mining. Similarly, the slow rate at which groundwater returns to some aquifers may limit the evaluation of plans for restoring water resources until years after the performance bonds required by SMCRA have been released.

Mine operators can reduce these uncertainties to some extent through knowledge gained about the mine-site geology and water resources during mining, and by monitoring the progress of reclamation. Research on techniques for characterizing overburden and on groundwater recharge rates would reduce the uncertainty further.

Other uncertainties about Western reclamation concern problems with baseline and monitoring data, with evaluating reclamation success, with unresolved technical issues about reclamation methods, and with reclamation research and innovation. The quantity and quality of data on Western reclamation have increased dramatically since SMCRA. However, data problems still limit the accuracy and efficiency of reclamation planning and evaluation. The large quantity of data being collected has created serious data management problems for mine operators and regulators. The lack of standardized or computer accessible formats for the data also makes it difficult for regulators to review and analyze the information, and complicates regional assessments (particularly of cumulative hydrologic impacts).

Moreover, useful data still are difficult to collect for some aspects of reclamation, either because collection methods are unreliable or are not standardized, or there are natural obstacles to data collection. For example, standardized methods are needed for collecting data on flow and water quality in ephemeral (seasonal) streams, and on the quality of wildlife habitats.

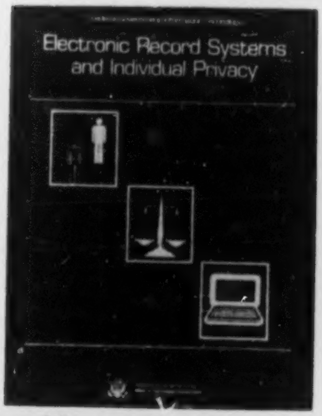
Uncertainties introduced by shortcomings in data management and analysis are compounded by the lack of criteria for evaluating the success of Western reclamation. Criteria have been formulated only for the first phase of bond release—backfilling the pit—in the five States studied (Colorado, Montana, New Mexico, North Dakota, and Wyoming). Furthermore, existing methods for judging postmining hydrology and revegetation have serious limitations, yet revegetation and hydrologic restoration are used as the primary indicators of success for soils, overburden, and wildlife.

Six outstanding technical issues about Western reclamation methods are:

- the unreliability of methods for predicting the acid-forming potential of Western mine spoils;
- the need for additional data to demonstrate that other methods of sediment control are as effective as sedimentation ponds and will have fewer adverse impacts;
- the importance for revegetation of optimizing use of the soil resource, and the constraints on soils optimization;
- the ability to meet uniform high shrub (e.g., sagebrush) revegetation standards, and whether lower overall shrub densities would resolve postmining conflicts between wildlife habitat and rangeland;
- the minimum attention paid to characterizing postmining land uses, and the resulting increase in land use conflicts; and
- the need to establish the value of landscape diversity.

Additional research could resolve most of the uncertainties about Western surface mine reclamation, and thus could increase the probability of reclamation success with fewer design problems and lower costs. However, cutbacks in Federal funding have significantly reduced reclamation research. Moreover, there are few vehicles for disseminating reclamation research results. This has led to delays in the approval of advanced reclamation techniques. The Office of Surface Mining's inflexible application of some reclamation standards, and its strict interpretation of SMCRA's provision for experimental practices, also have inhibited the adoption of innovative reclamation methods.

Electronic Record Systems and Individual Privacy



The Federal Government maintains over 3 billion records containing personal information in fully or partially computerized record systems. **The widespread and still growing use of computerized databases, electronic record searches and matches, and computer networking is leading rapidly to the creation of a *de facto* national database containing substantial personal information on most Americans.** Use of the social security number as a *de facto* national identifier is facilitating the development of this database.

Technological advances have opened up new possibilities for improving the efficiency of government recordkeeping; the detection and prevention of fraud, waste, and abuse; and law enforcement investigations. At the same time, the opportunities for inappropriate, unauthorized, or illegal access to and use of personal information have expanded. **New means of manipulating and analyzing computerized records have eroded the protections established by Congress in the Privacy Act of 1974**, and especially have undermined the long-standing policy that the government's need for information be balanced against the need to protect individual privacy. These new means include:

- **Computer matching,** the comparison of two or more computerized record systems to search for individuals who appear in more than one of them, is used by agencies to detect fraud, waste, and abuse. In the process, however, information is sometimes used for purposes other than those for which it was originally collected, a result discouraged by the Privacy Act. Over the last 5 years, Federal computer matching programs have tripled in number, involving about 2 billion different records.
- **Computer-assisted front-end verification,** the certification of the accuracy and completeness of information provided by an individual by checking similar information in computerized databases, is used to prevent ineligible people from receiving benefits. Such verification requires centralized databases, accessible at a distance through telecommunication lines. This increases the opportunities for improper disclosure and exchange of personal information.
- **Computer profiling,** a search of a record system for a specified combination of characteristics of interest to an agency, may aid in investigations (e.g., use by the Internal Revenue Service to identify income tax evaders). But profiling may result in people being treated as suspect before they have done anything to warrant such treatment, and without their being made aware of being singled out.

Most significantly, **there is little or no oversight or consideration of the privacy implications of Federal electronic record systems.** Under the Privacy Act, the Office of Management and Budget (OMB) is assigned responsibility for governmentwide oversight. OMB is not effectively monitoring such basic areas as: the quality (completeness and accuracy) of personal records; the protection of personal records in systems accessible by microcomputers; the cost-effectiveness of computer matching and similar applications; and the resources devoted to Privacy Act implementation. In addition, individuals have no easy way to see or correct their personal records stored in Federal systems. Furthermore, **neither the executive branch nor Congress provides a forum in which the privacy, management efficiency, and law enforcement implications of Federal electronic record system applications can be debated and resolved.** Without such a forum, agencies have little incentive to consider privacy concerns in their use of personal record systems.

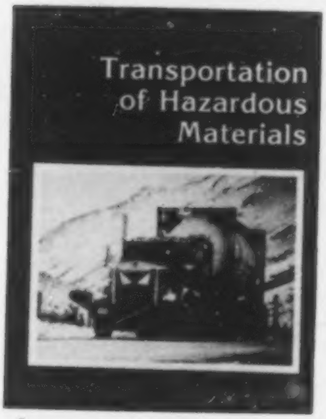
OTA has identified a number of policy actions for congressional consideration, ranging from taking no action to making changes in laws and institutions. Taking no action would continue the uncertainty regarding individual rights and agency responsibilities and the lack of effective oversight of agency practices. In addition, issues surrounding the *de facto* national database and national identifier would remain unresolved.

Possible congressional actions analyzed by OTA include:

1. Initiating institutional adjustments to improve oversight, e.g., strengthen the role of OMB, increase the Privacy Act staff in agencies, and/or improve congressional organization and procedures for consideration of information privacy issues. Additionally or separately, Congress could establish a new oversight or ombudsman mechanism such as a Data Protection Board or Privacy Commission.
2. Considering a number of problem-specific actions. For example:
   - —establish direct statutory control over Federal agency use of matching, front-end verification, and profiling;
   - —require controls on the use of microcomputers to access personal information in order to protect its privacy, confidentiality, and security;
   - —legislate more specific guidelines and requirements for accuracy and completeness of data/ records containing personal information; or
   - —review issues concerning use of the social security number as a *de facto* national identifier and, if necessary, restrict its use or legislate a new universal identification number.
3. Providing for systematic study of the broader social, economic, and political context of information policy, of which information

privacy is a part, for example by establishing a national study commission.

Transportation of Hazardous Materials



Transportation of Hazardous Materials

Although Americans take for granted many of the comforts of modern life provided by the petroleum, chemical, nuclear, and transportation industries, the hazardous materials used and produced by these industries can wreak enormous health and environmental damage if mishandled. The spectacular accidents that do occur during transport of hazardous materials, while relatively infrequent, emphasize the harm that can be done. Fortunately, most hazardous materials are transported safely. Industry, being aware of the dangers of the products and its liability for damages, for the most part takes appropriate precautions to preserve public and environmental safety.

Over 1.5 billion tons of hazardous materials are transported annually by land, sea, and air in the United States, more than half by trucks. Because trucks can travel anywhere there is a highway, unhindered by the need for a waterway, railbed, or airport, public exposure to an accidental release of a hazardous material from truck transport is more likely than for water, rail, or air.

Federal data on transportation patterns and accidents is fragmented, incomplete, and not helpful to State and local officials, who need information on hazardous materials production and transportation for planning and preparing for emergencies. Federal accident and spill recordkeeping are so uncoordinated that many accidents are not recorded. Damages from hazardous materials transportation accidents appear to be at least 10 times higher than that reported by the Department of Transportation.

The basic Federal regulatory structure has been developed largely by industry over the last 100 years. There have been no far-reaching regulatory reforms and no strategic changes to cope with late 20th century technologies and public concerns. Furthermore, the regulatory process for containers works against innovation in design, making the United States less competitive in the international market.

Shipments of hazardous materials are governed by extensive requirements codified in Title 49 of the Code of Federal Regulations. The Department of Transportation (DOT), the Environmental Protection Agency, the Nuclear Regulatory Commission, the Department of Energy, and the Federal Emergency Management Agency all address hazardous materials problems. Federal programs that provide technical assistance to State and local governments are uncoordinated, and many find them insufficient and underfunded as well. Because State and local jurisdictions feel Federal regulations do not provide adequate safety, they have passed additional regulations to control risks. The resulting regulatory patchwork complicates enforcement and training and is burdensome to industry.

Human failure or lack of information and advance planning, rather than equipment or regulatory shortcomings, usually cause most accidents, injuries, or environmental damage. Indeed, over 60 percent of reported vehicle accidents and hazardous materials spills are caused by human error.

Four major policy issues require congressional consideration to address some of these shortcomings and modernize the system:

- **Training.***—Development of a national strategy to provide training for State and local emergency response and enforcement personnel. Key components—training guidelines, adequate funding, and comprehensive information on existing resources.
- **Federal/State Regulations.***—Greater consistency in Federal, State, and local regulations and enforcement. Requiring that hazardous materials released during intrastate highway transport be reported to the Federal Government. Coordination and cooperation between all levels of government in developing regulations.
- **Public Information.***—Increased availability of information. Establishing national guidelines for community right-to-know legislation. Better coordination of Federal data-collection activities. Federal assistance for State and local information gathering.
- **Containers.***—Better Federal coordination in setting container regulations, including those for spent nuclear fuel. Two areas for specific attention: technical requirements and operational and procedural practices.

Problems that underlie these four issues are lack of clearly defined Federal and State roles and ineffective coordination to make Federal activities more accessible and cost-effective. The basic structure to address these issues already exists, but lack of communication and integration among the different levels of government diminishes effectiveness.

Policy Issues

- **Training.**—Development of a national strategy to provide training for the Nation's estimated 1.5 million State and local emergency response and enforcement personnel is the primary unmet need. Training guidelines for different levels of response, adequate funding (particularly at the local level), and comprehensive information on existing resources are necessary. Although many public and private training programs exist, they are not standardized and do not address the needs of personnel in small urban or rural areas where there is little familiarity with hazardous materials. A modest annual program of $15 to $20 million could supplement existing State, private, and local expenditures. Possible Federal funding sources include general tax revenue, the Superfund tax, the fuel tax, or a special fund derived from a user fee levied on industry.

Training for enforcement is far better organized, but Federal budget constraints have reduced Federal enforcement below an effective level. Additional State and local enforcement officers must be trained to fill the gap and ensure that safety regulations are followed.

- **Federal/State Regulations.**—Greater consistency in Federal, State, and local regulations would improve enforcement and ease burdens on interstate carriers. Although regulating intrastate activities has traditionally been left to the States, a national truck driver's license, administered by the States, and Federal assessment of State hazardous materials laws to determine whether they are more or less stringent than Federal regulations would be useful first steps toward greater regulatory consistency. Federal assistance to States and local jurisdictions considering routing restrictions or other independent regulation of hazardous materials could ensure that decisions take into account the needs of neighboring jurisdictions and provide a level of safety at least equivalent to Federal regulations. Requiring that hazardous materials released during intrastate highway transport be reported to Federal regulators would provide far more complete information on hazardous materials spills.
- **Public Information.**—Improved information about the transportation of hazardous materials, including shipments of spent nuclear fuel, would help State emergency planning and preparedness. National guidelines for community right-to-know legislation could bolster local information gathering.

  Improving coordination of Federal data-collection activities could help DOT set regulatory priorities and provide useful information for State and local planning. Locally conducted data collection, such as hazardous materials facilities inventories and transportation surveys, has value beyond the data it produces, as the concerned parties begin to work together. However, OTA finds that a comprehensive, real-time database on all hazardous materials shipments is neither feasible nor cost-effective.
- **Containers.**—Better Federal coordination in setting container regulations for rail, highway, water, and air is essential. The standards set by the Nuclear Regulatory Commission for spent fuel containers produce exceptionally durable containers, if the standards are meticulously followed during cask manufacture and transportation. If these conditions are met, the containers provide a much greater degree of public protection than that afforded in any other current

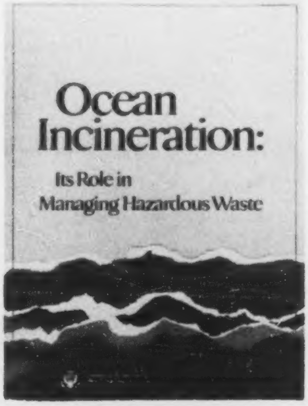
hazardous material shipping activity. State, local, and Indian tribe officials should be an integral part of decisionmaking by the Department of Energy about its shipments of highly radioactive materials under the Nuclear Waste Policy Act.

Two areas warrant specific attention: 1) technical requirements, such as changes in gasoline cargo tankers and design tests for spent fuel casks; and 2) operational and procedural practices, such as quality control and industry training.

Accident data raise serious questions about the safety of transportation for two types of containers—the stability of the tank trucks used to transport gasoline and the types of truck chassis that carry the sturdy, versatile portable tanks suitable for transport by ship, rail, or truck. The Department of Transportation should scrutinize the standards for each of these with great care.

Ocean Incineration: Its Role in Managing Hazardous Waste

Few hazardous waste management practices have generated as much controversy and polarization as ocean incineration—burning hazardous wastes in incinerators mounted on ocean-going vessels. While proponents advocate ocean incineration as a needed alternative to land-based disposal practices, critics contend it will only ship our problems out to sea. Debate over ocean incineration centers on several questions: Given the alternatives, are risks to humans and the environment acceptable? Are regulations adequate and responsive to public concerns? Can waste generators and handlers be held liable for damages? Will use of ocean incineration slow the introduction of preferred practices?



These and other concerns have led the United States to temporarily halt the use of ocean incineration. As a result, **the Nation must decide whether to proceed with an ocean incineration program and, if so, how.**

What are the capabilities and limitations of ocean incineration? In contrast to land-based disposal practices, incineration can destroy more than 99 percent of certain hazardous wastes, largely breaking them down into less harmful or more easily managed substances (primarily water vapor and carbon dioxide). Metals from the waste and small quantities of undestroyed waste that are also released may be harmful, however, and must be stringently controlled.

Burning chlorinated wastes generates an additional product, toxic hydrogen chloride gas. To prevent human exposure to this gas, land-based incinerators must neutralize it using a difficult "scrubbing" process which itself generates hazardous waste. Ocean incineration, which would occur far from humans, would use seawater's natural ability to neutralize the gas.

Land-based incineration's primary risk is to humans, through exposure to routine emissions. In contrast, ocean incineration's primary risk is to marine waters, from an accidential spill which would be difficult or impossible to clean up. Its major risk to humans would probably arise from land, not marine, transportation.

Up to 20 percent of the 250 million metric tons of hazardous waste generated annually in the United States could, in principle, be incinerated. Organic liquids—up to 10 percent of hazardous wastes—could be incinerated at sea. These are among the most toxic and concentrated of hazardous wastes. Today, as much as two-thirds of these liquid wastes is disposed of on land or used as fuel in boilers and furnaces. Only small amounts are now incinerated, all on land.

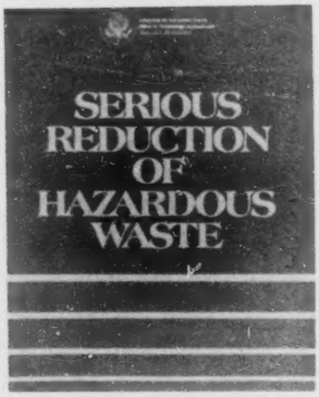
OTA finds that ocean incineration could be an attractive, though not essential, interim option for managing certain liquid wastes, in particular those that are highly chlorinated. Ocean incineration would be neither a panacea nor an obstacle to solving the Nation's hazardous waste problems. Several options like ocean incineration will be needed to bridge the gap between hazardous waste disposal practices of the past (such as landfilling), which are being abandoned, and preferred practices of the future (such as waste reduction), whose capacity is only now developing. Time will be required to implement such preferred practices and they may not be applicable to all wastes.

OTA's analysis of the capabilities and limitations of ocean incineration cannot answer many of the questions raised in the debate. Nor does it resolve the fundamental choice of whether to develop some kind of program. Given the wide disparity of viewpoints, difficult policy decisions will be required. Although the choice has generally been viewed in all-or-nothing terms, OTA's analysis suggests intermediate alternatives that warrant consideration. Four policy options that cover a range of approaches are evaluated: 1) permanently halt ocean incineration and rely entirely on land-based options; 2) temporarily halt commercial ocean incineration pending more research; 3) proceed with commercial ocean incineration under the proposed regulatory framework; and 4) proceed with a modified program that confers an interim status to the activity and addresses legitimate deficiencies and concerns.

Ocean incineration should have only limited effects on overall incentives for shifting to use of preferred management practices. **To ensure that this shift is not impeded, however, any ocean incineration program should be structured to be interim.** Several approaches might be used to control a program's scale and duration and ensure that use of ocean incineration is supplanted by better technologies as they develop.

Finally, if a program were developed, several issues —for example, regulating hazardous waste transportation and incinerator emissions— would need resolution in order to conduct ocean incineration in as safe and environmentally sound a manner as possible.

Serious Reduction of Hazardous Waste



Waste reduction is an economically sensible response to what many people see as a hazardous waste crisis. Several thousand pounds of hazardous waste are generated annually for every person in the Nation. Many thousands of people have lost their drinking water because of contamination by toxic waste. Across the country there are thousands of sites contaminated by hazardous waste that require billions of dollars for cleanup. An increasing number of lawsuits are being brought by people who claim to have suffered adverse health effects from living near toxic waste sites. Also the number of lawsuits being instituted by the government is mounting rapidly. These suits claim that certain waste generators have not complied with regulations and that generators who have used waste management facilities now on the Superfund list must pay for cleanups.

Waste reduction is critical to the prevention of future hazardous waste problems. By reducing the generation of waste, industry can use materials more efficiently and achieve more certain protection for health and the environment. At the same time, industry can lower waste management and regulatory compliance costs, liabilities, and risks.

Although there are many environmental and economic benefits to waste reduction, **over 99 percent of Federal and State environmental spending is devoted to controlling pollution after waste is generated. Less than 1 percent is spent to reduce the generation of waste.** The current level of national spending for pollution control is about $70 billion. Two-thirds of this is spent by industry. Since many hazardous substances are not yet regulated, annual expenditures will, in all likelihood, continue to increase.

OTA finds that reducing waste to prevent pollution from being generated at its source is now a practical way to complement this costly pollution control regulatory system. Because of sporadic and uneven enforcement, the current regulatory system weakens the incentive to reduce waste. Waste reduction, no matter how far it is taken, cannot eliminate all wastes, but it can help to lower costs for environmental protection as regulations continue to expand.

Current pollution control methods often do little more than move waste around. For example: air and water pollution control devices typically generate solid, hazardous waste that goes to landfills and too often leaches from there into groundwater. Many hazardous wastes, such as most toxic air emissions, are not yet regulated, and regulatory standards for permissible emissions legally sanction the generation of some wastes. Thus, **OTA finds that establishing a comprehensive, multimedia approach to reducing wastes going into the air, land, and water is essential.**

OTA finds that there is no common definition of waste reduction; there are few or no data on the extent of industrial waste reduction; waste reduction is usually measured incorrectly; and the information that the government collects on waste generation is not useful for waste reduction. If waste reduction is defined to include waste treatment, companies will naturally pay more attention to treatment, which is a familiar activity, than to the reduction of waste. **Problems of definition and lack of information should be addressed and ongoing waste reduction efforts should be documented by government, even if decisions to reduce waste remain at the discretion of individual companies.**

Despite some claims to the contrary, industry has not taken advantage of all effective waste reduction opportunities that are available. Reducing waste involves more than buying a black box, reading the directions, and plugging it in. Even a simple step toward waste reduction can seem difficult to a company with few technical resources and no obvious place to go for guidance. Reducing waste in an industrial process requires intimate knowledge of all aspects of that specific production process, in contrast to waste treatment, which is essentially an add-on to the end of the process. There are also clear pressures to reduce waste tomorrow, rather than today. **The attention and resources given to required pollution control activities limit the amount of thought, time, and money that industry can devote to waste reduction.** Some U.S. companies, however, have verified the fact that waste reduction pays for itself relatively quickly, especially when compared to the time needed to comply with regulations, obtain regulatory permits, or site waste management facilities. Some companies are even beginning to sell new products and services that help others to reduce waste.

Waste reduction succeeds when it is part of the everyday consciousness of all workers and managers involved with production—where the waste reduction opportunities are—rather than when it is a job only of those responsible for complying with environmental regula-

tions. A few people with end-of-pipe, pollution control jobs are not in a position to reduce waste by themselves; such efforts must involve upstream workers and facilities.

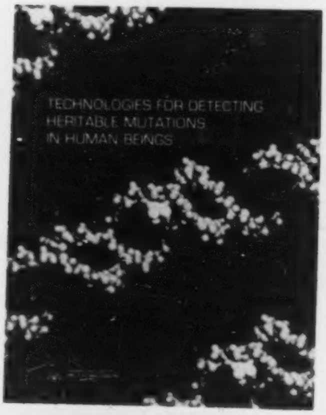
There are five distinct approaches that industry can take to reduce hazardous waste: 1) change the raw materials of production, 2) change production technology and equipment, 3) improve production operations and procedures, 4) recycle waste within the plant, and 5) redesign or reformulate end-products. Among the opportunities that exist for common processes and wastes are: a) using mechanical techniques rather than toxic organic solvents to clean metal surfaces, b) using water-based raw materials instead of materials based on organic solvents, and c) changing plant practices to generate less hazardous wastewater.

So far government has not required waste reduction. **OTA finds that it would be extraordinarily difficult for government to set and enforce waste reduction standards for a myriad of industrial processes.** The impact on industry, particularly on troubled manufacturing sectors, could be substantial. Alternatively, the United States could move to an economically sensible environmental protection strategy based on **both pollution control** (waste management) **and pollution prevention** (waste reduction) with the Federal Government providing leadership and assistance in the following ways.

First, through policy development, education, and oversight, Congress could help industry and the Nation profit from seeing waste reduction not as some unique technology, but as a field ready for innovative engineering and management. These opportunities are embedded in every part of the industrial production system. There is no way to predetermine the amount of waste reduction that is possible; its technical and economic feasibility depend on the characteristics, circumstances, and goals of specific waste generators. Success in reducing waste depends on the ability of organizations to modernize, innovate, and cut costs, thereby increasing profits and reducing long-term liabilities. Thus waste reduction could be used as a measure of performance as energy efficiency and productivity often are.

Second, there are a number of possible legislative actions that could clarify the definition of waste reduction, spur better collection of information on waste reduction, and encourage waste generators to devote more attention to the subject. If the Federal public policy goal is rapid and comprehensive hazardous waste reduction, then a strategy based on government leadership and assistance rather than on prescriptive requirements is likely to be the most effective. For example, Congress could: 1) create an Office of Waste Reduction with an Assistant Administrator within EPA, 2) create a grants program to develop generic or widely transferable technical support for waste reduction, 3) through new comprehensive waste reduction legislation require detailed reporting by industry on past waste reduction actions and plans for future efforts, 4) reward and facilitate waste reduction by offering industry concessions from existing pollution control regulatory requirements, or 5) create and use independent State Waste Reduction Boards to implement programs. Setting a national waste reduction goal of perhaps 10 percent annually could help convert the long stated importance of waste reduction into a true priority and reduce annual environmental spending substantially, ultimately by billions of dollars.

Technologies for Detecting Heritable Mutations in Human Beings



Of the known or suspected effects of exposures to chemical and physical agents in the environment—cancer, birth defects, and mutations—heritable mutations are the most poorly understood and the most lasting, affecting not just individuals, but also their descendants.

Congress singled out the risk of mutations in the Toxic Substances Control Act of 1976 (TSCA) and again in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or "Superfund"). These laws, and numerous others that encompass health effects broadly, require that the public be protected from exposures that can cause mutations. Yet current methods are entirely inadequate to determine whether exposures to environmental chemicals and radiation are important influences on the frequency of heritable mutations in the population.

Experiments with animals have shown that some substances in agricultural, industrial, and pharmaceutical chemicals in use today cause heritable mutations in some lower animals. In human beings, however, specific causes of heritable mutations are unknown; there is no direct evidence that radiation or chemicals have induced mutations in human germ cells. The observable effects of mutations encompass a broad range of conditions, e.g., embryonic, fetal, and neonatal deaths; severe physical and mental disabilities; and increases in susceptibility to common, chronic diseases.

OTA examined innovative, developing technologies for detecting and measuring new heritable mutations in human beings. Because most of these technologies involve examining the DNA directly (**see over**), they represent a greater degree of sophistication and potentially a major advance. Currently available techniques use more indirect approaches that rely on the clinical manifestation of disease, major changes in chromosome number or structure, or biochemical changes in certain blood proteins, none of which offers specific information about the variety of mutations that can occur, their frequency, or their causes.

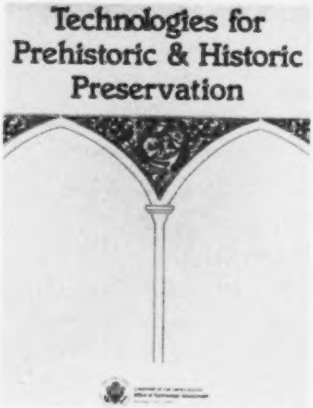
The emerging technologies may provide reasonable and verifiable ways of detecting new mutations in human DNA and proteins, but they are not yet efficient or accurate enough to justify use on a large scale. With continued support, some of the new technologies described in this report, or derivatives of them, could be available in the next 5 to 10 years for large-scale use. Their ultimate application in epidemiologic studies to determine rates and patterns of mutations will be complex, requiring the collaboration of a large number of scientists. Collection of the necessary information about background mutation rates and rates in high-risk populations would require special funding mechanisms and commitment of a large amount of money over a period of years.

Without the development of these technologies, the Federal Government will continue to lack the information to frame rational laws and regulations to protect people from mutagens. It will also lack the tools to adequately evaluate risks from occupational and environmental exposures. Continuing to rely on inadequate knowledge about the causes and effects of mutations could result in poorly-informed decisions about acceptable levels of exposure and the level of resources needed to provide protection from such exposures.

Policy options in this assessment include congressional actions and priorities that could influence the pace and direction of research toward: 1) solving technical problems, 2) improving the quality and efficiency of preliminary validity testing and field trials of the methods, and 3) encouraging the integration of animal and human studies directed at identifying the mechanisms of mutagenesis and the relationships between mutagenic potencies in animals and in human beings.

Technologies for Prehistoric and Historic Preservation

The United States is losing important parts of its cultural heritage at an alarming rate. Preserving America's prehistoric and historic sites contributes to our quality of life, and that of future generations, by increasing our understanding of U.S. history. It also provides economic benefits such as jobs and increased tourism.


Technologies for
Prehistoric & Historic
Preservation

To carry out their legal responsibilities for preserving these important historical resources, Federal agencies must have cost-effective methods for studying and protecting them. Modern technologies may provide cost-effective methods to help stem the loss of these irreplaceable resources, especially if technologies developed in other fields can be transferred to preservation. The lack of adequate technology transfer demonstrates a conspicuous need for an institution to coordinate research, disseminate information, and provide training about new technologies. Congress could establish:

- **a Federal Center for Preservation Technology** within the Department of the Interior or some other agency;
- **a National Center for Preservation Technology** managed by a consortium of universities; or
- **a Preservation Technology Board** composed of professionals from all parts of the preservation community, to provide guidance for a Center.

The stewardship of prehistoric and historic cultural resources has not received sufficient attention within the Department of the Interior and other Federal agencies. Congress could consider altering the institutional structure of Federal preservation efforts by:

- establishing a separate agency to manage all Federal cultural programs;
- creating an independent agency devoted to the care and protection of prehistoric and historic cultural resources;
- reorganizing the Department of the Interior to provide for an Assistant Secretary for Natural and Cultural Resources; or
- leaving the current Federal preservation structure intact.

Even if the structure were left intact, Federal agencies could still improve their efforts by developing sustained, organized maintenance programs for historic Federal properties; improving coordination and information sharing among agencies; and focusing on using new, efficient technologies.

Some foreign countries have been using advanced technologies for preservation longer than the United States. In some cases their technologies represent significant advances over U.S. practices. Foreign experiences with preservation techniques, methods, and equipment should be examined closely for possible transfer to U.S. applications.

Preserving Historic Structures.—Tax incentives now available for rehabilitating qualified historic buildings demonstrate the success of the public-private sector partnership in historic preservation. Their continued availability would assist the retention of many more of America's historic structures.

Landscapes Preservation.—Significant prehistoric and historic landscapes continue to be lost because they are not recognized as important to U.S. history. Passage and implementation of the Olmsted Heritage Landscapes Act of 1985 (H.R. 37) could aid the collection of information on all U.S. historic designed landscapes. It could also enhance public awareness of other significant prehistoric and historic landscapes.

Shipwrecks Preservation.—Historic shipwrecks in coastal waters, receive very little protection from current Admiralty Laws. Yet they contain a wealth of important information concerning the exploration and settlement of this country. Passage and implementation of the proposed Abandoned Shipwrecks Act (H.R. 3558/S. 2569) would make it possible to preserve significant historic shipwrecks for future generations by ceding their jurisdiction, ownership, and oversight to the States.

Stemming Looting and Vandalism.—Both are serious threats to prehistoric and historic cultural resources. Advanced monitoring devices may aid the law enforcement process, but the United States also needs to improve enforcement of policies dealing with illicit excavation and trafficking in stolen artifacts. Congress could consider amending the Archaeological Resources Protection Act of 1979 and other statutes to permit private registration of antiquities obtained in supervised archaeological excavations on private land.

SPECIAL REPORTS

Plant Closing: Advance Notice and Rapid Response

Drawn from a workshop and research by OTA and GAO, this special report assesses the benefits and costs of advance notice and examines issues in the debate over mandatory advance notice. The report also assesses the ability of public agencies to provide worker adjustment services rapidly and effectively when employers do give notice.

Technology, Trade, and the U.S. Residential Construction Industry

This special report analyzes regulatory and policy alternatives that might encourage research and development in the housing industry.

Trade in Services: Exports and Foreign Revenues

OTA examines alternative methods of defining and measuring international services trade—distinguishing, in particular, between direct exports (or imports) and the revenues of foreign affiliates of U.S. companies. The report estimates the level of U.S. international trade in services over the period 1982 to 1984, and compares these estimates with the official figures reported in the U.S. balance of payments.

Continuing the Commitment: Agricultural Development in the Sahel

Special report examining the record of assistance to nine nations of the Sahel in West Africa, explores the lessons learned in a decade of efforts, and suggests policy implications of more effective U.S. assistance there and elsewhere in Africa. The report emphasizes the technical and institutional factors that constrain development in one of the poorest regions in the world.

Technologies for NATO's Follow-On Forces Attack Concept

NATO's new FOFA concept (Follow-On Forces Attack, or striking deep against enemy forces moving forward to join the battle) is part of an effort to deal with the growing imbalance between NATO and Warsaw Pact conventional forces in Europe. The November 1984 adoption of the FOFA concept by NATO, with strong U.S. support, raises the question of how the U.S. military should exploit emerging technology to implement it, and poses the issue of relative priorities of FOFA and other critical military objectives. This special report reviews both the opertional concepts that underlie this initiative and the technical developments of interest, and then suggests some guidelines to follow in making procurement decisions.

Second Report on the Prospective Payment Assessment Commission (ProPAC)

OTA's second report of this Commission updates information on appointments and staffing of the Commission, the status of various administrative and operating activities, and the substantive areas of concentration. It analyzes ProPAC's progress in operating as an organization, in relating to outside groups, and in fulfilling its mandate. It concludes with OTA's overall views on ProPAC's second year and discusses issues that Congress may wish to consider.

Transportation of Hazardous Materials: State and Local Activities

This special report summarizes Federal programs and identifies three major areas of State and local government concern: prevention and enforcement activities, emergency response and training, and planning and data gathering. The report outlines related issues, describes methods by which jurisdictions are responding to them, and documents the concerns that the Federal Government could address.

Potential Effects of Section 3 of the Federal Coal Leasing Amendments Act of 1976

In this special report, OTA examines a range of alternative legislative options for modifying section 3 and encourages the timely development of Federal coal leases including allowing nonproducing lessees to keep their eligibility by paying an annual fee. These nonproduction payments could generate additional Federal revenues and, perhaps, recapture a portion of value of old leases originally sold at very low prices.

Displaced Homemakers: Programs and Policy

Displaced homemakers are a large, often overlooked group of people, mostly women, who have lost their primary source of income and face serious difficulties in finding adequate jobs. Many of these women have not worked in a paid job in recent years, although they often have skills developed in education, homemaking, past work experience, or volunteer activities. There are an estimated 2 to 4 million displaced homemakers, and their numbers are growing.

This interim report assesses the needs of displaced homemakers and describes existing services. It also suggests possible avenues for congressional direction and oversight in displaced homemaker programs.

TECHNICAL MEMORANDA

New Structural Materials Technologies: Opportunities for the Use of Advanced Ceramics and Composites

Technical memorandum analyzing the military and commercial opportunities presented by new structural materials technologies and outlines the Federal research and development priorities which are consistent with those opportunities.

Research Funding as an Investment: Can We Measure the Returns?

This technical memorandum explores the various methods of quantitative analysis, both economic and noneconomic, that have been applied to research funding.

The Regulatory Environment for Science

The social and legal forces that restrict or regulate scientific and engineering research in the United States today are examined in this technical memorandum. This technical memorandum examines the entire regulatory environment for research, analyzes the structures and mechanisms for regulation, and identifies emerging policy issues that may require congressional attention in the future.

Marine Applications for Fuel Cell Technology

Fuel cell technology is one of the most promising of the new electric power technologies being developed, but to date almost no attention has been given to potential marine applications. This technical memorandum evaluates the likely benefits and problems of using fuel cells for propulsion and auxiliary power at sea.

Demographic Trends and the Scientific and Engineering Work Force

This technical memorandum covers undergraduate and graduate science education, the academic market for science and engineering Ph.Ds, the industrial market for engineers, demographics and equality of opportunity, and the education and utilization of biomedical research personnel.

BACKGROUND PAPERS

Space Stations and the Law: Selected Legal Issues

Analyzes some of the legal consequences of developing and operating an international space station. It describes the different ways that an international space station might be owned and operated and ex-plains how each could affect the rights and responsibilities of the U.S. Government and its citizens. The background paper gives special attention to the application of jurisdiction, tort law, intellectual property law, and criminal law to nations and individuals living and working in space. In addition to these specific legal issues, the paper also examines the role of politics and technology in legal decisionmaking, the usefulness of air law and maritime law analogies, and the conflict between State and Federal law and jurisdiction in the United States.

Hearing Impairment and Elderly People

Describes the most common types and causes of hearing impairment in the elderly and reviews technologies such as hearing aids, assistive listening devices, signaling and telecommunications devices, and environmental design technologies that can be used to compensate for hearing loss. The background paper also emphasizes the need for more public information about technologies that compensate for hearing loss and improved service delivery systems that are adapted to the characteristics of the elderly.

Assessing Biological Diversity in the United States: Data Considerations

This background paper outlines how data can be used in maintaining biological diversity; describes primarily the Federal institutions that collect biological data; provides an overview of existing Federal biological databases; discusses technical aspects of collecting, storing, and retrieving biological data; and suggests ways to improve biological databases so that they can be better used to help maintain diversity of this Nation's plant and animal life.

Microelectronics Research & Development

Background paper describing the current state of research and development in microelectronics by examining the range of R&D efforts and the sources of Federal and private support for R&D. It also presents potential policy concerns that stem from existing arrangements for direct Federal support and from changes underway in microelectronics R&D.

Scientific Use of Supercomputers

Provides a review of the Federal Government's large-scale computing programs and examines the networking and software programs within selected agencies.

Grassroots Conservation of Biological Diversity in the United States

Background paper examining efforts to maintain biological diversity in the United States by "grassroots" activities—individuals and groups of private citizens that contribute to the conservation of a wide variety of plants, animals, and habitats.

CASE STUDY

Effects of Federal Policies on Extracorporeal Shock Wave Lithotripsy

Health case study analyzing the effects of Federal health policies on extracorporeal shock wave lithotripsy (ESWL) and its integration into the American health care system. It describes the incidence of urinary stones and the need for stone treatment and presents a brief overview of the literature on the safety and efficacy of alternative treatments for urinary stones. In addition, the case study reviews the evidence on the safety and efficacy of ESWL itself and discusses the effects of the requirements of FDA on its development, describes the costs and economics of providing ESWL and the payment policies of the Federal Government, particularly Medicare, that affect the adoption and use of this technology, and examines the effects of health planning policies on ESWL and discusses its future direction and use.

WORKSHOP PROCEEDINGS

Technology and the Future of the U.S. Construction Industry

Workshop proceedings prepared by OTA and published by The American Institute of Architects Press which explores topics such as commercial building designs, energy use in buildings, and the future utilization of computers in the construction industry.

Section III.—Work in Progress

More than 51 projects were in progress during fiscal year 1986, which included 23 new studies.

This section lists the titles of assessments underway or in press, as of September 30, 1986. For a full description of these projects, please refer to the current "Assessment Activities," OTA-PC-105. This booklet may be obtained from OTA by calling OTA's Publication Request Line (202) 224-8996.

Energy, Materials, and International Security Division

Technology and the American economic transition

Energy and Materials Program

- High-technology ceramics and polymer composites
- Magnetic fusion research and development
- Competitiveness of domestic copper
- Technological risks and opportunities for future U.S. energy supply and demand

Industry, Technology, and Employment Program

- International competitiveness in the service industries
- Technology, innovation, and U.S. trade

International Security and Commerce Program

- Technology transfer to China
- Alternatives for improving NATO's defense response
- Strategic defense initiative: technology, survivability and software
- Seismic verification of nuclear test limitation treaties

Health and Life Sciences Division

Biological Applications Program

- Life-sustaining technologies and the elderly
- Disorders causing dementia
- New developments in biotechnology
- Infertility prevention and treatment
- Mapping the human genome

Food and Renewable Resources Program

- Technologies to maintain biological diversity
- Integrated renewable resource management for U.S. insular areas
- Low-resource agriculture in Africa
- Technology and public policy to enhance grain quality in international trade

Health Program

- Monitoring of mandated Vietnam veterans studies (mandated study)
- Technology and child health
- Nontraditional methods of cancer management: science and policy issues
- Assessing the quality of medical care
- Diagnostic medical tests: impact on public and private policies toward health care

Science, Information, and Natural Resources Division

Communication and Information Technologies Program

- New communications technology: implications for privacy and security
- Technology, public policy, and the changing nature of Federal information dissemination
- Communications systems for an information age

Oceans and Environment Program

- Wastes in marine environments
- Technologies to control illegal drug traffic
- Technologies for exploring and developing U.S. Exclusive Economic Zones
- New Clean Air Act issues

Science, Education, and Transportation Program

- Sustaining the national technological base: education and employment of scientists and engineers
- Educational technology: an assessment of practice and potential

Section IV.—Organization and Operations

Created by the Technology Assessment Act of 1972 [86 Stat. 797], OTA is an agency of the legislative branch of the Federal Government (a copy of the Act is found in app. C, p. 132). OTA's primary function is to provide congressional committees with assessments or studies that identify the range of probable positive and negative consequences, social as well as physical, of policy alternatives affecting the uses of technology.

In providing assistance to Congress, OTA is to: identify existing or probable impacts of technology or technological programs; where possible, ascertain cause-and-effect relationships of the applications of technology; identify alternative technological methods of implementing specific actions; identify alternative programs for achieving requisite goals; estimate and compare the impacts of alternative methods and programs; present findings of completed analyses to the appropriate legislative authorities; identify areas where additional research or data collection is required to provide support for assessments; and undertake such additional associated activities as may be necessary.

The Act provides for a bipartisan congressional board, a director, and such other employees and consultants as may be necessary to conduct the Office's work. The congressional board is made up of six Senators, appointed by the President pro tempore of the Senate, and six Representatives, appointed by the Speaker of the House, evenly divided by party. In 1986, Sen. Ted Stevens (R-Alaska) and Cong. Morris Udall (D-Arizona) served as the Chairman and Vice Chairman, respectively, of the board. The two posts alternate between the Senate and House with each Congress. The board members from each Chamber select their respective officer.

The congressional board sets the policies of the Office and is the sole and exclusive body governing OTA. The board appoints the director, who is OTA's chief executive officer and a nonvoting member of the board.

The Act also calls for a Technology Assessment Advisory Council composed of 10 public members eminent in scientific and technological fields, the Comptroller General of the United States, and the Director of the Congressional Research Service of the Library of Congress. The advisory council advises the board and the director on such matters as the balance, comprehensiveness, and quality of OTA's work, and OTA's nongovernmental resources.

Requests for OTA assessments may be initiated by:

- the chairman of any standing, special, select, or joint committee of Congress, acting alone, at the request of the ranking minority member, or at the request of a majority of the committee members;

- the OTA board; or
- the OTA Director, in consultation with the board.

The authorization of specific assessment projects and the allocation of funds for their performance are the responsibilities of the OTA Board.

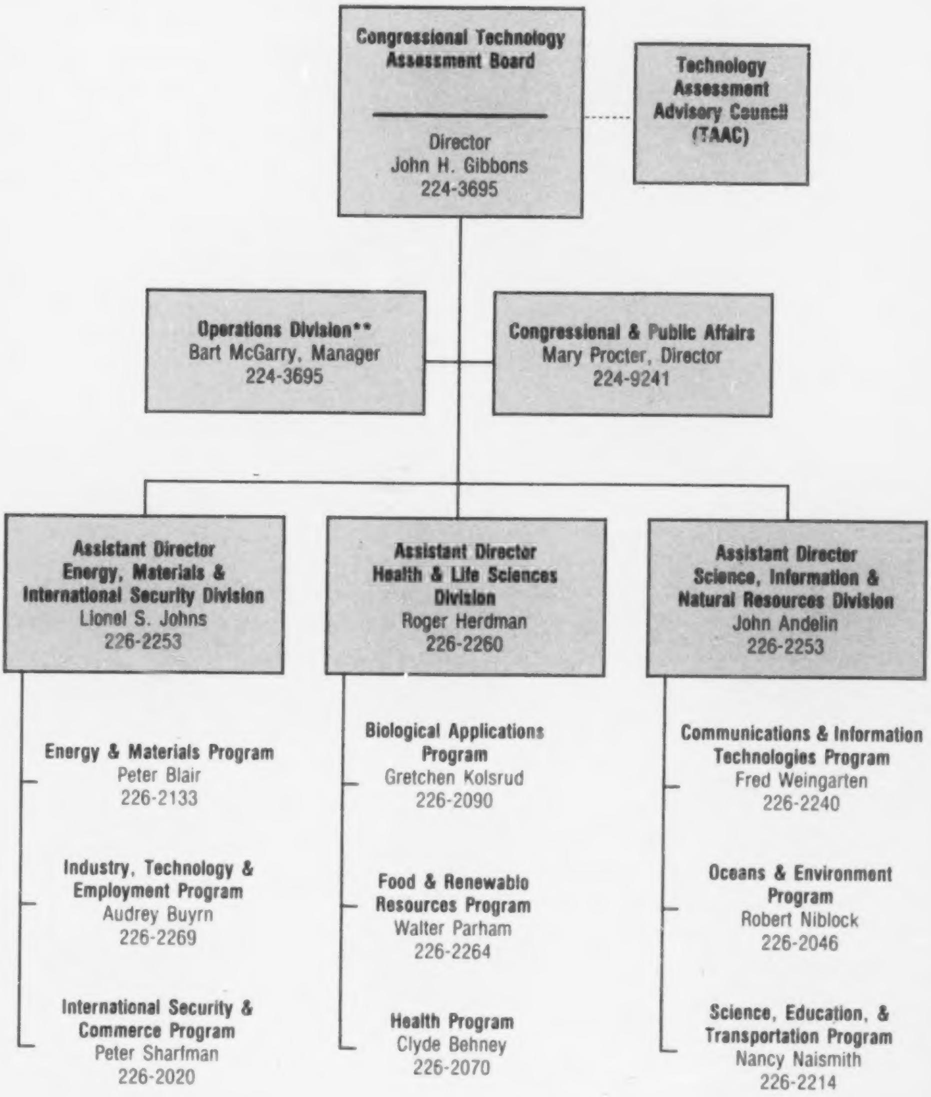
The analytical work of the Office is organized into three divisions, each headed by an assistant director. They encompass assessments grouped in the areas of energy and materials; international security and commerce; industry, technology, and employment; biological applications; food and renewable resources; health; communication and information technologies; oceans and environment; and science, education, and transportation. (See chart detailing OTA's organizational structure.)

Staff professionals represent a wide range of disciplines and backgrounds, including the physical, biological, and environmental sciences, engineering, social sciences, law, and public administration. Professionals from executive branch agencies, detailed to OTA on a temporary basis, and participants in several congressional fellowship programs also contribute to the work of the Office.

The private sector is heavily involved in OTA studies as a source of expertise and perspectives. Contractors and consultants are drawn from industry, universities, private research organizations, and public interest groups.

OTA works to ensure that the views of the public are fairly reflected in its assessments. OTA involves the public in many ways—through advisory panels, workshops, and formal and informal public meetings. These interactions provide citizens with access to information and help OTA to remain sensitive to the full array of perspectives, not only of the recognized stakeholders, but also of technically trained and lay persons.

OTA* ORGANIZATION CHART


Congressional Technology Assessment Board
Director
John H. Gibbons
224-3695
Technology Assessment Advisory Council (TAAC)
Operations Division**
Bart McGarry, Manager
224-3695
Congressional & Public Affairs
Mary Procter, Director
224-9241
Assistant Director
Energy, Materials & International Security Division
Lionel S. Johns
226-2253
Assistant Director
Health & Life Sciences Division
Roger Herdman
226-2260
Assistant Director
Science, Information & Natural Resources Division
John Andelin
226-2253
Energy & Materials Program
Peter Blair
226-2133
Industry, Technology & Employment Program
Audrey Buyrn
226-2269
International Security & Commerce Program
Peter Sharfman
226-2020
Biological Applications Program
Gretchen Kolsrud
226-2090
Food & Renewable Resources Program
Walter Parham
226-2264
Health Program
Clyde Behney
226-2070
Communications & Information Technologies Program
Fred Weingarten
226-2240
Oceans & Environment Program
Robert Niblock
226-2046
Science, Education, & Transportation Program
Nancy Naismith
226-2214

*Located at 600 Pennsylvania Ave., S.E., Washington, DC.
- Publication request line—224-8996.
- Personnel locator—224-8713.

**Operations Division consists of the following units: Administrative Services, Budget and Finance Office, Information Center, Personnel Office, Telecommunications and Information Services, and Publishing Office.

OPERATIONS

Publishing Activities

During fiscal year 1986, OTA delivered 44 published documents to Congress. These included: 19 assessment reports, 5 technical memoranda, 6 background papers, 1 health technology case study, 9 special reports, and 4 administrative reports.

Requests for OTA Publications

During the period September 30, 1985 through October 1, 1986, OTA's Publishing Office received an average of 62 telephone and mail requests per day. Additional requests were processed by OTA program offices and the OTA Congressional and Public Affairs Office and are not included in the above statistics.

Private Sector Reprinting of OTA Publications

To date, 56 OTA publications have been reprinted (in whole or in part) by commercial publishers or private organizations. Among the reports reprinted during the fiscal year were:

- Princeton University Press (NJ) reprinted the following: Ballistic Missile Defense Technology; Anti-Satellite Weapons Countermeasures, and Arms Control; and Directed Energy Missile Defense in Space.
- Springer Publishing Co. (NY) reprinted Medicare's Prospective Payment System: Strategies for Evaluating Cost, Quality, and Medical Technology;
- JETRO Publishing Co. (Japan) translated and reprinted the following: Technology, Innovation, and Regional Economic Development: Background Paper #1: Census of State Government Initiatives for High-Technology Industrial Development; and Background Paper #2: Encouraging High-Technology Development; and
- Krieger Publishing Co. (FL) reprinted Intellectual Property Rights in An Age of Electronics and Information.

Sales of Publications

Government Printing Office.—Sales of OTA publications by the Superintendent of Documents continue to increase. In fiscal year 1986, the cumulative number of titles on sale was 199 and GPO has sold a total of 47,128 copies of OTA's reports.

National Technical Information Service.—NTIS sells scientific reports and papers that are, generally, not in great demand but are useful for scientific researchers. NTIS is the outlet for OTA's assessment working papers and contractor reports, plus those reports that are out of print by GPO. During fiscal year 1986, NTIS sold 1,223 copies of OTA reports.

Organization Roster of OTA Staff as of September 1986

OFFICE OF THE DIRECTOR

John H. Gibbons, *Director*
Sue Bachtel, *Executive Assistant*
Glenda Lawing, *Secretary*
Barbara Murphy, *Secretary*

Congressional and Public Affairs Office

Mary Procter, *Director, Congressional and Public Affairs*
Jean McDonald, *Press Officer*
Ellen Mika, *Assistant Press Officer*
Karen Piccione, *Administrative Assistant*
Eugenia Ufholz, *Congressional Relations Officer*

Medical Services

Rose McNair, *Resident Nurse*

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Lionel Johns, *Assistant Director*
Beth Alexiou, *Division Assistant*

Technology and Economic Transition

Henry Kelly, *Senior Associate*
Tina Brumfield, *Secretary*
Joy Dunkerley, *Senior Analyst*
Zeda Rosenberg, *Analyst*
Andrew Wyckoff, *Analyst*

Energy and Materials Program

Peter Blair, *Program Manager*
Pidge Chapman, *Administrative Assistant*
Gerald Epstein, *Analyst*
Gregory Eyring, *Analyst*
Karen Larsen, *Senior Analyst*
Linda Long, *Administrative Secretary*
John Newman, *Analyst*
Steve Plotkin, *Senior Analyst*
Jenifer Robison, *Senior Analyst*
Ray Williamson, *Senior Analyst*

Industry, Technology, and Employment Program

Audrey Buyrn, *Program Manager*
John Alic, *Senior Associate*
Wendell Fletcher, *Senior Analyst*
Kitty Gillman, *Senior Analyst*
Julie Gorte, *Senior Analyst*
Joel Hirschhorn, *Senior Associate*
Kirsten Oldenburg, *Analyst*
Edna Thompson, *Administrative Assistant*

International Security and Commerce Program

Peter Sharfman, *Program Manager*
Eric Basques, *Senior Analyst*
Michael Callaham, *Senior Analyst*
Jannie Coles, *Secretary*
Alan Crane, *Senior Associate*
Richard Dalbello, *Senior Analyst*
Martha Harris, *Senior Analyst*
Tom Karas, *Senior Analyst*
Gordon Law, *Senior Analyst*
Nancy Lubin, *Analyst*
Cecile Parker, *Secretary*
Jackie Robinson, *Administrative Assistant*
Alan Shaw, *Senior Analyst*

HEALTH AND LIFE SCIENCES DIVISION

Roger Herdman, *Assistant Director*
Jackie McGee, *Division Assistant*
Kerry Kemp, *Analyst*

Biological Applications Program

Gretchen Kolsrud, *Program Manager*
Tim Condon, *Analyst*
Robert Cook-Deegan, *Senior Analyst*
Gary Ellis, *Senior Analyst*
Luther Val Giddings, *Analyst*
Catharine Maslow, *Analyst*
Robyn Nishimi, *Analyst*
Sharon Oatman, *Administrative Assistant*
Linda Rayford, *Secretary*
Gladys White, *Analyst*

Food and Renewable Resources Program

Walter E. Parham, *Program Manager*
Patricia Durana, *Research Analyst*
Beckie Erickson, *Administrative Assistant*
Nellie Hammond, *Secretary*
Alison Hess, *Analyst*
Edward MacDonald, *Analyst*
Mike Phillips, *Senior Associate*
Susan Shen, *Analyst*
Carolyn Swann, *Secretary*
Phyllis Windle, *Senior Analyst*

Health Program

Clyde J. Behney, *Program Manager*
Anne Kesselman Burns, *Analyst*
Ginny Cwalina, *Administrative Assistant*
Denise Dougherty, *Analyst*
Carol Guntow, *Secretary*
Diann Hohenthaner, *PC Specialist*
Larry Miike, *Senior Associate*
Gloria Ruby, *Senior Analyst*
Jane Sisk, *Senior Associate*
Judith Wagner, *Senior Associate*

Special Projects

Hellen Gelband, *Analyst*
Karl Kronebusch, *Analyst*
Julie Ostrowsky, *Analyst*

SCIENCE, INFORMATION, AND NATURAL RESOURCES DIVISION

John Andelin, *Assistant Director*
Doris Smith, *Division Assistant*
Paul Phelps, *Analyst*

Communication and Information Technologies Program

Rick Weingarten, *Program Manager*
Prue Adler, *Analyst*
Karen Bandy, *Analyst*
Vary Coates, *Senior Analyst*
Elizabeth Emanuel, *Administrative Assistant*
Linda Garcia, *Senior Analyst*
Mary Ann Madison, *Analyst*
Audrey Newman, *Administrative Secretary*
Priscilla Regan, *Analyst*
Sandra Serbinoff. *Secretary*
Jean Smith, *Analyst*
Chuck Wilk, *Senior Analyst*
Fred Wood, *Senior Analyst*

Oceans and Environment Program

Robert Niblock, *Program Manager*
Bill Barnard, *Senior Analyst*
Kathleen Beil, *Administrative Assistant*
Rosina Bierbaum, *Analyst*
James Curlin, *Senior Associate*
Richard Denison, *Analyst*
Robert Friedman, *Senior Associate*
Joan Harn, *Analyst*
Gretchen Hund, *Analyst*
Peter Johnson, *Senior Associate*
Daniel Kevin, *Analyst*
Howard Levenson, *Analyst*
Bill Westermeyer, *Analyst*

Science, Education, and Transportation Program

Nancy Naismith, *Program Manager*
Chris Clary, *Administrative Secretary*
Kevin Dopart, *Analyst*
Marsha Fenn, *Administrative Assistant*
Larry Jenney, *Senior Analyst*
Edith Page, *Senior Analyst*
Linda Roberts, *Senior Analyst*
Fran Rudoff, *Analyst*

OPERATIONS DIVISION

Bart McGarry, *Operations Manager*
Holly Gwin, *General Counsel*

Administrative Services

Thomas P. McGurn, *Administrative Officer*
Alexandra Ferguson, *Director of Contracts*

Edith Franzen, *Conference Center Coordinator*
Elizabeth Mills, *Procurement Assistant*

Budget and Finance Office

Catherine Singleton, *Budget and Finance Officer*
Karen Carrington, *Voucher Examiner*
Carolyn Datcher, *Accounting Assistant*
Carolyn Harris, *Budget Assistant*
Frances Hemingway, *Assistant Budget and Finance Officer*
Phil Jackson, *Financial Systems Computer Analyst*

Information Center

Martha Dexter, *Manager, Information Services*
Suzanne Boisclair, *Information Technician*
Vermille Davis, *Information Technician*
Leslie Fleming, *Information Technician*
Gail Kouril, *Assistant Manager, Information Services*

Personnel Office

William Norris, *Personnel Officer*
Lola Craw, *Personnel Specialist*
Denise DeSanctis, *Personnel Specialist*
Marsha Williams, *Administrative Assistant*

Publishing Office

Kathie S. Boss, *Publishing Officer*
John Bergling, *Graphic Designer/Illustrator*
Debra Datcher, *Publishing Specialist*

Telecommunications and Information Services

John Bell, *Senior Systems Integration Analyst*
Bryan Harrison, *Office Automation Systems Analyst*
Brenda Miller, *Software Systems Specialist*

Appendixes

Appendix A
Technology Assessment Advisory Council

The Technology Assessment Advisory Council (TAAC) was established by OTA's statute, and members are appointed by OTA's Congressional Technology Assessment Board (TAB). The Council advises TAB and the Director on issues and other matters related to science, technology, and technology assessment.

Members of TAAC on September 30, 1986, were:

William J. Perry, *Chairman*

Dr. Perry is managing partner of H&Q Technology Partners. In 1985 he was a managing director in the investment banking firm of Hambrecht & Quist, Inc. Prior to joining H&Q, he was the U.S. Under Secretary of Defense for Research and Engineering. He is a member of the National Academy of Engineering. He is a member of the National Academy of Engineering.

David S. Potter, *Vice Chairman*

Dr. Potter retired as Vice President, Power Products and Defense Operations Group at General Motors in June 1985. He was formerly Assistant Secretary of the Navy for Research and Development and Under Secretary of the Navy. He is a member of the National Academy of Engineering.

Earl Beistline

Dr. Beistline is a private consultant in Fairbanks, Alaska. He is former Dean of the School of Mineral Industry, and also Former Provost of the University of Alaska.

Claire T. Dedrick

Dr. Dedrick is Executive Officer of the State Land Commission of California. She is a former member of the State of California Air Resources Board, a former California Public Utilities Commissioner, and has served as Secretary for Resources with The Resources Agency of the State of California.

S. David Freeman

Mr. Freeman is currently a private consultant. He is former Chairman and member of the Board of the Tennessee Valley Authority. He has headed the energy policy staff of the President's Office of Science and Technology Policy; directed the Ford Foundation Energy Policy Project; and served as assistant to the Chairman of the Federal Power Commission.

Michel T. Halbouty

Mr. Halbouty is Chairman of the Board of Michel T. Halbouty Energy Co. in Houston, Texas. Prior to establishing his company, he was a chief geologist and petroleum engineer with Glenn H. McCarthy and also with Yount-Lee Oil Co.

Carl N. Hodges

Professor Hodges is Director of the University of Arizona Environmental Research Laboratory and Chairman of the Arizona Solar Energy Commission. He currently serves as a member of the National Academy of Sciences' Advisory Committee on Technology Innovation and as a member of the Arizona-Mexico Commission. Professor Hodges is a Fellow of the American Association for the Advancement of Science.

Rachel McCulloch

Dr. McCulloch is Associate Professor of Economics at the University of Wisconsin, on leave in 1985 at the Hoover Institution at Stanford University. She has served as a consultant to the Federal Reserve Board; is a former member of the U.S. Cabinet Task Force on Oil Import Control; and served as a member of the Presidential Commission on Industrial Competitiveness.

Chase N. Peterson

Dr. Peterson is President of the University of Utah. He practiced medicine at the Salt Lake Clinic and taught at the LDS Hospital and University of Utah Medical School until his appointment as Dean of Admissions and Financial Aids at Harvard College. There he also served as Vice President for Alumni Affairs and Development. Dr. Peterson returned to the University of Utah in 1978 as Vice President for Health Sciences, and has served as University President since 1983.

Lewis Thomas

Dr. Thomas is President Emeritus of the Memorial Sloan-Kettering Cancer Center and University Professor at the State University of New York at Stony Brook. He is a former member of the President's Biomedical Research Panel and of the President's Science Advisory Committee. Dr. Thomas is a distinguished lecturer and author in the medical field. He received the National Book Award in the arts and letters for his book, *Lives of a Cell*. Dr. Thomas is a member of the National Academy of Sciences and the Institute of Medicine.

Statutory Members

Charles A. Bowsher

Mr. Bowsher is Comptroller General of the United States and Director of the U.S. General Accounting Office.

Joseph E. Ross

Mr. Ross is Director of the Congressional Research Service, U.S. Library of Congress.

Appendix B
List of Advisors and Panel Members*

ENERGY, MATERIALS, AND INTERNATIONAL SECURITY DIVISION

Technology and Economic Transition

Technology and the American Economic Transition Advisory Panel

David S. Saxon, *Chair*
Chairman of the Corporation
Massachusetts Institute of Technology

Claude Ballard
Partner
Goldman Sachs

William Baumol
Department of Economics
Princeton University

Harvey Brooks
Professor
Aiken Computation Laboratory
Division of Applied Sciences
Harvard University

Richard Crowder
Senior Vice President for Strategic Planning and Corporate Risk Officer
Pillsbury Co.

Judy Gregory
Research Associate
Department of Professional Employees
AFL-CIO

Henry Lichstein
Vice Chairman
Citibank

Mary Jo Manning
Partner
Wilkes, Artis, Hedrick, & Lane

Ray Marshall
Professor
LBJ School of Public Affairs
University of Texas

John J. McNamara
President
Young & Rubicam USA

Kathleen O'Reilly
Executive Director
Citizens Utility Board

Charles F. Sabel
Professor
Department of Science, Technology, and Society
Massachusetts Institute of Technology

George M. Scalise
Senior Vice President and Administrative Officer
Advanced Micro Devices

Albert Sobey
Director of Energy and Advanced Product Economics
General Motors Corp.

Barbara Starfield
Division of Health Policy
Johns Hopkins School of Hygiene and Public Health

Arthur G. Wirth
Department of Education
Washington University

Howard Young
Special Consultant to the President
United Auto Workers

Workshop: International Competitiveness of U.S. Agriculture

Arnold Aho
School of Architecture
Mississippi State University

T.R. Arnold
President
T.R. Arnold & Associates, Inc.

Steven L. Biegel
Consultant
National Institute of Building Sciences

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*Affiliations are at time of appointment to panel or workshop.

James R. Birdsong
Executive Director
Home Manufacturers Council
National Association of Home Builders

H.E. Blomgren
President
National Manufactured Housing Federation, Inc.

Alton S. Bradford
Assistant Commander for Engineering and Design
Naval Facilities Engineering Command
U.S. Department of the Navy

Vincent M. Brannigan
Department of Textiles and Consumer Economics
University of Maryland, Adelphi

Don O. Carlson
Editor and Publisher
Automation in Housing Magazine

David E. Claridge
Building Energy Engineering Program
University of Colorado, Boulder

Michael Clevenger
Principal Technical Consultant
Real Estate Division
Xerox Corp.

Henry Collins
Vice President for Governmental Affairs
Underwriters Laboratories, Inc.

William M. Connolly
Director
Division of Housing
State of New Jersey

Thomas Dagostino
Deputy Director
Office of Classification
U.S. Department of Energy

Albert Dietz
Department of Architecture and Planning
Massachusetts Institute of Technology

Eric Dluhosch
School of Architecture and Planning
Massachusetts Institute of Technology

David E. Dowall
IURD
University of California, Berkeley

John P. Eberhard
Executive Director
Advisory Board on the Built Environment
National Academy of Sciences

Workshop: Future of Construction

Alton S. Bradford
Assistant Commander for Engineering and Design
Naval Facilities Engineering Command
U.S. Department of the Navy

Don O. Carlson
Editor and Publisher
Automation in Housing Magazine

David E. Claridge
Building Energy Engineering Program
University of Colorado, Boulder

Michael Clevenger
Principal Technical Consultant
Real Estate Division
Xerox Corp.

Albert Dietz
Department of Architecture and Planning
Massachusetts Institute of Technology

Eric Dluhosch
School of Architecture and Planning
Massachusetts Institute of Technology

John P. Eberhard
Executive Director
Advisory Board on the Built Environment
National Academy of Sciences

James G. Gross
Deputy Director
Center for Building Technology
National Bureau of Standards

Harry Mileaf
Director of Technology and Product Development
McGraw-Hill Information Systems Co.

John P. Millhone
Director
Office of Building Energy Research and Development
U.S. Department of Energy

Piero N. Patri
President
Whisler-Patri

Richard C. Reisman
Associate
Whisler-Patri

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The Regulatory Environment for Science Advisory Group

Harvey Brooks, *Chair*
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Irving S. Johnson
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Lilly Research Laboratories

Jonathan A. King
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Massachusetts Institute of Technology

Alan McGowan
President
Scientists' Institute for Public
Information

John Shattuck
Vice President of Government,
Community, and Public Affairs
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Workshop: Research Funding as an Investment

Harvey Averch
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Committee

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Workshop: Sustaining the National Technological Base: Education and Employment of Scientists and Engineers

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Workshop: Drug Detection Technologies

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Workshop: Marine Sensors

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Workshop: Advanced Marine Vehicles

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Workshop: Surveying and Exploring the Exclusive Economic Zone

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Appendix C
OTA Act

Public Law 92-484
92nd Congress, H. R. 10243
October 13, 1972

An Act

86 STAT. 797

To establish an Office of Technology Assessment for the Congress as an aid in the identification and consideration of existing and probable impacts of technological application; to amend the National Science Foundation Act of 1950; and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Technology Assessment Act of 1972".

Technology Assessment Act of 1972.

FINDINGS AND DECLARATION OF PURPOSE

SEC. 2. The Congress hereby finds and declares that:

(a) As technology continues to change and expand rapidly, its applications are—

(1) large and growing in scale; and

(2) increasingly extensive, pervasive, and critical in their impact, beneficial and adverse, on the natural and social environment.

(b) Therefore, it is essential that, to the fullest extent possible, the consequences of technological applications be anticipated, understood, and considered in determination of public policy on existing and emerging national problems.

(c) The Congress further finds that:

(1) the Federal agencies presently responsible directly to the Congress are not designed to provide the legislative branch with adequate and timely information, independently developed, relating to the potential impact of technological applications, and

(2) the present mechanisms of the Congress do not and are not designed to provide the legislative branch with such information.

(d) Accordingly, it is necessary for the Congress to—

(1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social, and political effects of such applications; and

(2) utilize this information, whenever appropriate, as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological applications.

ESTABLISHMENT OF THE OFFICE OF TECHNOLOGY ASSESSMENT

SEC. 3. (a) In accordance with the findings and declaration of purpose in section 2, there is hereby created the Office of Technology Assessment (hereinafter referred to as the "Office") which shall be within and responsible to the legislative branch of the Government.

Technology Assessment Board.

(b) The Office shall consist of a Technology Assessment Board (hereinafter referred to as the "Board") which shall formulate and promulgate the policies of the Office, and a Director who shall carry out such policies and administer the operations of the Office.

Duties.

(c) The basic function of the Office shall be to provide early indications of the probable beneficial and adverse impacts of the applications of technology and to develop other coordinate information which may assist the Congress. In carrying out such function, the Office shall:

(1) identify existing or probable impacts of technology or technological programs;

(2) where possible, ascertain cause-and-effect relationships;

(3) identify alternative technological methods of implementing specific programs;

(4) identify alternative programs for achieving requisite goals;

(5) make estimates and comparisons of the impacts of alternative methods and programs;

(6) present findings of completed analyses to the appropriate legislative authorities;

(7) identify areas where additional research or data collection is required to provide adequate support for the assessments and estimates described in paragraph (1) through (5) of this subsection; and

(8) undertake such additional associated activities as the appropriate authorities specified under subsection (d) may direct.

(d) Assessment activities undertaken by the Office may be initiated upon the request of:

(1) the chairman of any standing, special, or select committee of either House of the Congress, or of any joint committee of the Congress, acting for himself or at the request of the ranking minority member or a majority of the committee members;

(2) the Board; or

(3) the Director, in consultation with the Board.

Information, availability.

(e) Assessments made by the Office, including information, surveys, studies, reports, and findings related thereto, shall be made available to the initiating committee or other appropriate committees of the Congress. In addition, any such information, surveys, studies, reports, and findings produced by the Office may be made available to the public except where—

(1) to do so would violate security statutes; or

(2) the Board considers it necessary or advisable to withhold such information in accordance with one or more of the numbered paragraphs in section 552(b) of title 5, United States Code.

81 Stat. 54.

TECHNOLOGY ASSESSMENT BOARD

Membership.

Sec. 4. (a) The Board shall consist of thirteen members as follows:

(1) six Members of the Senate, appointed by the President pro tempore of the Senate, three from the majority party and three from the minority party;

(2) six Members of the House of Representatives appointed by the Speaker of the House of Representatives, three from the majority party and three from the minority party; and

(3) the Director, who shall not be a voting member.

Vacancies.

(b) Vacancies in the membership of the Board shall not affect the power of the remaining members to execute the functions of the Board and shall be filled in the same manner as in the case of the original appointment.

Chairman and vice chairman.

(c) The Board shall select a chairman and a vice chairman from among its members at the beginning of each Congress. The vice chairman shall act in the place and stead of the chairman in the absence of the chairman. The chairmanship and the vice chairmanship shall alternate between the Senate and the House of Representatives with each Congress. The chairman during each even-numbered Congress shall be selected by the Members of the House of Representatives on the Board from among their number. The vice chairman during each

Congress shall be chosen in the same manner from that House of Congress other than the House of Congress of which the chairman is a Member.

Meetings.

Subpena.

(d) The Board is authorized to sit and act at such places and times during the sessions, recesses, and adjourned periods of Congress, and upon a vote of a majority of its members, to require by subpena or otherwise the attendance of such witnesses and the production of such books, papers, and documents, to administer such oaths and affirmations, to take such testimony, to procure such printing and binding, and to make such expenditures, as it deems advisable. The Board may make such rules respecting its organization and procedures as it deems necessary, except that no recommendation shall be reported from the Board unless a majority of the Board assent. Subpenas may be issued over the signature of the chairman of the Board or of any voting member designated by him or by the Board, and may be served by such person or persons as may be designated by such chairman or member. The chairman of the Board or any voting member thereof may administer oaths or affirmations to witnesses.

DIRECTOR AND DEPUTY DIRECTOR

Appointment.

Compensation.

83 Stat. 863.

SEC. 5. (a) The Director of the Office of Technology Assessment shall be appointed by the Board and shall serve for a term of six years unless sooner removed by the Board. He shall receive basic pay at the rate provided for level III of the Executive Schedule under section 5314 of title 5, United States Code.

(b) In addition to the powers and duties vested in him by this Act, the Director shall exercise such powers and duties as may be delegated to him by the Board.

(c) The Director may appoint with the approval of the Board, a Deputy Director who shall perform such functions as the Director may prescribe and who shall be Acting Director during the absence or incapacity of the Director or in the event of a vacancy in the office of Director. The Deputy Director shall receive basic pay at the rate provided for level IV of the Executive Schedule under section 5315 of title 5, United States Code.

Employment restriction.

(d) Neither the Director nor the Deputy Director shall engage in any other business, vocation, or employment than that of serving as such Director or Deputy Director, as the case may be; nor shall the Director or Deputy Director, except with the approval of the Board, hold any office in, or act in any capacity for, any organization, agency, or institution with which the Office makes any contract or other arrangement under this Act.

AUTHORITY OF THE OFFICE

SEC. 6. (a) The Office shall have the authority, within the limits of available appropriations, to do all things necessary to carry out the provisions of this Act, including, but without being limited to, the authority to—

(1) make full use of competent personnel and organizations outside the Office, public or private, and form special ad hoc task forces or make other arrangements when appropriate;

Contracts.

(2) enter into contracts or other arrangements as may be necessary for the conduct of the work of the Office with any agency or instrumentality of the United States, with any State, territory,

or possession or any political subdivision thereof, or with any person, firm, association, corporation, or educational institution, with or without reimbursement, without performance or other bonds, and without regard to section 3709 of the Revised Statutes (41 U.S.C. 5);

(3) make advance, progress, and other payments which relate to technology assessment without regard to the provisions of section 3648 of the Revised Statutes (31 U.S.C. 529);

(4) accept and utilize the services of voluntary and uncompensated personnel necessary for the conduct of the work of the Office and provide transportation and subsistence as authorized by section 5703 of title 5, United States Code, for persons serving without compensation;

80 Stat. 499; 83 Stat. 190.

(5) acquire by purchase, lease, loan, or gift, and hold and dispose of by sale, lease, or loan, real and personal property of all kinds necessary for or resulting from the exercise of authority granted by this Act; and

(6) prescribe such rules and regulations as it deems necessary governing the operation and organization of the Office.

Recordkeeping.

(b) Contractors and other parties entering into contracts and other arrangements under this section which involve costs to the Government shall maintain such books and related records as will facilitate an effective audit in such detail and in such manner as shall be prescribed by the Office, and such books and records (and related documents and papers) shall be available to the Office and the Comptroller General of the United States, or any of their duly authorized representatives, for the purpose of audit and examination.

(c) The Office, in carrying out the provisions of this Act, shall not, itself, operate any laboratories, pilot plants, or test facilities.

Agency cooperation.

(d) The Office is authorized to secure directly from any executive department or agency information, suggestions, estimates, statistics, and technical assistance for the purpose of carrying out its functions under this Act. Each such executive department or agency shall furnish the information, suggestions, estimates, statistics, and technical assistance directly to the Office upon its request.

Personnel detail.

(e) On request of the Office, the head of any executive department or agency may detail, with or without reimbursement, any of its personnel to assist the Office in carrying out its functions under this Act.

(f) The Director shall, in accordance with such policies as the Board shall prescribe, appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act.

ESTABLISHMENT OF THE TECHNOLOGY ASSESSMENT ADVISORY COUNCIL

SEC. 7. (a) The Office shall establish a Technology Assessment Advisory Council (hereinafter referred to as the "Council"). The Council shall be composed of the following twelve members:

Membership.

(1) ten members from the public, to be appointed by the Board, who shall be persons eminent in one or more fields of the physical, biological, or social sciences or engineering or experienced in the administration of technological activities, or who may be judged qualified on the basis of contributions made to educational or public activities;

(2) the Comptroller General; and

(3) the Director of the Congressional Research Service of the Library of Congress.

Duties.

(b) The Council, upon request by the Board, shall—

(1) review and make recommendations to the Board on activities undertaken by the Office or on the initiation thereof in accordance with section 3(d);

(2) review and make recommendations to the Board on the findings of any assessment made by or for the Office; and

(3) undertake such additional related tasks as the Board may direct.

Chairman and Vice Chairman.

(c) The Council, by majority vote, shall elect from its members appointed under subsection (a)(1) of this section a Chairman and a Vice Chairman, who shall serve for such time and under such conditions as the Council may prescribe. In the absence of the Chairman, or in the event of his incapacity, the Vice Chairman shall act as Chairman.

Term of office.

(d) The term of office of each member of the Council appointed under subsection (a)(1) shall be four years except that any such member appointed to fill a vacancy occurring prior to the expiration of the term for which his predecessor was appointed shall be appointed for the remainder of such term. No person shall be appointed a member of the Council under subsection (a)(1) more than twice. Terms of the members appointed under subsection (a)(1) shall be staggered so as to establish a rotating membership according to such method as the Board may devise.

Travel expenses.

80 Stat. 498;
83 Stat. 190.
5 USC 5701.

(e)(1) The members of the Council other than those appointed under subsection (a)(1) shall receive no pay for their services as members of the Council, but shall be allowed necessary travel expenses (or, in the alternative, mileage for use of privately owned vehicles and a per diem in lieu of subsistence at not to exceed the rate prescribed in sections 5702 and 5704 of title 5, United States Code), and other necessary expenses incurred by them in the performance of duties vested in the Council, without regard to the provisions of subchapter 1 of chapter 57 and section 5731 of title 5, United States Code, and regulations promulgated thereunder.

Compensation.

(2) The members of the Council appointed under subsection (a)(1) shall receive compensation for each day engaged in the actual performance of duties vested in the Council at rates of pay not in excess of the daily equivalent of the highest rate of basic pay set forth in the General Schedule of section 5332(a) of title 5, United States Code, and in addition shall be reimbursed for travel, subsistence, and other necessary expenses in the manner provided for other members of the Council under paragraph (1) of this subsection.

UTILIZATION OF THE LIBRARY OF CONGRESS

SEC. 8. (a) To carry out the objectives of this Act, the Librarian of Congress is authorized to make available to the Office such services and assistance of the Congressional Research Service as may be appropriate and feasible.

(b) Such services and assistance made available to the Office shall include, but not be limited to, all of the services and assistance which the Congressional Research Service is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the Congressional Research Service under law performs for or on behalf of the Congress. The Librarian is, however, authorized to establish within the Congressional Research Service such additional divisions, groups, or other organizational entities as may be necessary to carry out the purpose of this Act.

(d) Services and assistance made available to the Office by the Congressional Research Service in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Librarian of Congress.

UTILIZATION OF THE GENERAL ACCOUNTING OFFICE

SEC. 9. (a) Financial and administrative services (including those related to budgeting, accounting, financial reporting, personnel, and procurement) and such other services as may be appropriate shall be provided the Office by the General Accounting Office.

(b) Such services and assistance to the Office shall include, but not be limited to, all of the services and assistance which the General Accounting Office is otherwise authorized to provide to the Congress.

(c) Nothing in this section shall alter or modify any services or responsibilities, other than those performed for the Office, which the General Accounting Office under law performs for or on behalf of the Congress.

(d) Services and assistance made available to the Office by the General Accounting Office in accordance with this section may be provided with or without reimbursement from funds of the Office, as agreed upon by the Board and the Comptroller General.

COORDINATION WITH THE NATIONAL SCIENCE FOUNDATION

SEC. 10. (a) The Office shall maintain a continuing liaison with the National Science Foundation with respect to—

(1) grants and contracts formulated or activated by the Foundation which are for purposes of technology assessment; and

(2) the promotion of coordination in areas of technology assessment, and the avoidance of unnecessary duplication or overlapping of research activities in the development of technology assessment techniques and programs.

Scientific programs, financing.
82 Stat. 360.

(b) Section 3(b) of the National Science Foundation Act of 1950, as amended (42 U.S.C. 1862(b)), is amended to read as follows:

"(b) The Foundation is authorized to initiate and support specific scientific activities in connection with matters relating to international cooperation, national security, and the effects of scientific applications upon society by making contracts or other arrangements (including grants, loans, and other forms of assistance) for the conduct of such activities. When initiated or supported pursuant to requests made by any other Federal department or agency, including the Office of Technology Assessment, such activities shall be financed whenever feasible from funds transferred to the Foundation by the requesting official as provided in section 14(g), and any such activities shall be unclassified and shall be identified by the Foundation as being undertaken at the request of the appropriate official."

64 Stat. 156;
82 Stat. 365.
42 USC 1873.

ANNUAL REPORT

SEC. 11. The Office shall submit to the Congress an annual report which shall include, but not be limited to, an evaluation of technology assessment techniques and identification, insofar as may be feasible, of technological areas and programs requiring future analysis. Such report shall be submitted not later than March 15 of each year.

APPROPRIATIONS

SEC. 12. (a) To enable the Office to carry out its powers and duties, there is hereby authorized to be appropriated to the Office, out of any money in the Treasury not otherwise appropriated, not to exceed $5,000,000 in the aggregate for the two fiscal years ending June 30, 1973, and June 30, 1974, and thereafter such sums as may be necessary.

(b) Appropriations made pursuant to the authority provided in subsection (a) shall remain available for obligation, for expenditure, or for obligation and expenditure for such period or periods as may be specified in the Act making such appropriations.

Approved October 13, 1972.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 92-469 (Comm. on Science and Astronautics) and
No. 92-1436 (Comm. of Conference).
SENATE REPORT No. 92-1123 (Comm. on Rules and Administration).
CONGRESSIONAL RECORD, Vol. 118 (1972):
Feb. 8, considered and passed House.
Sept.14, considered and passed Senate, amended.
Sept.22, Senate agreed to conference report.
Oct. 4, House agreed to conference report.

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